JANUARY 1991
ISSUE #364
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73 Amateur Radio Today

WORKBENCH PROJECTS YOU CAN BUILD!

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73 Reviews

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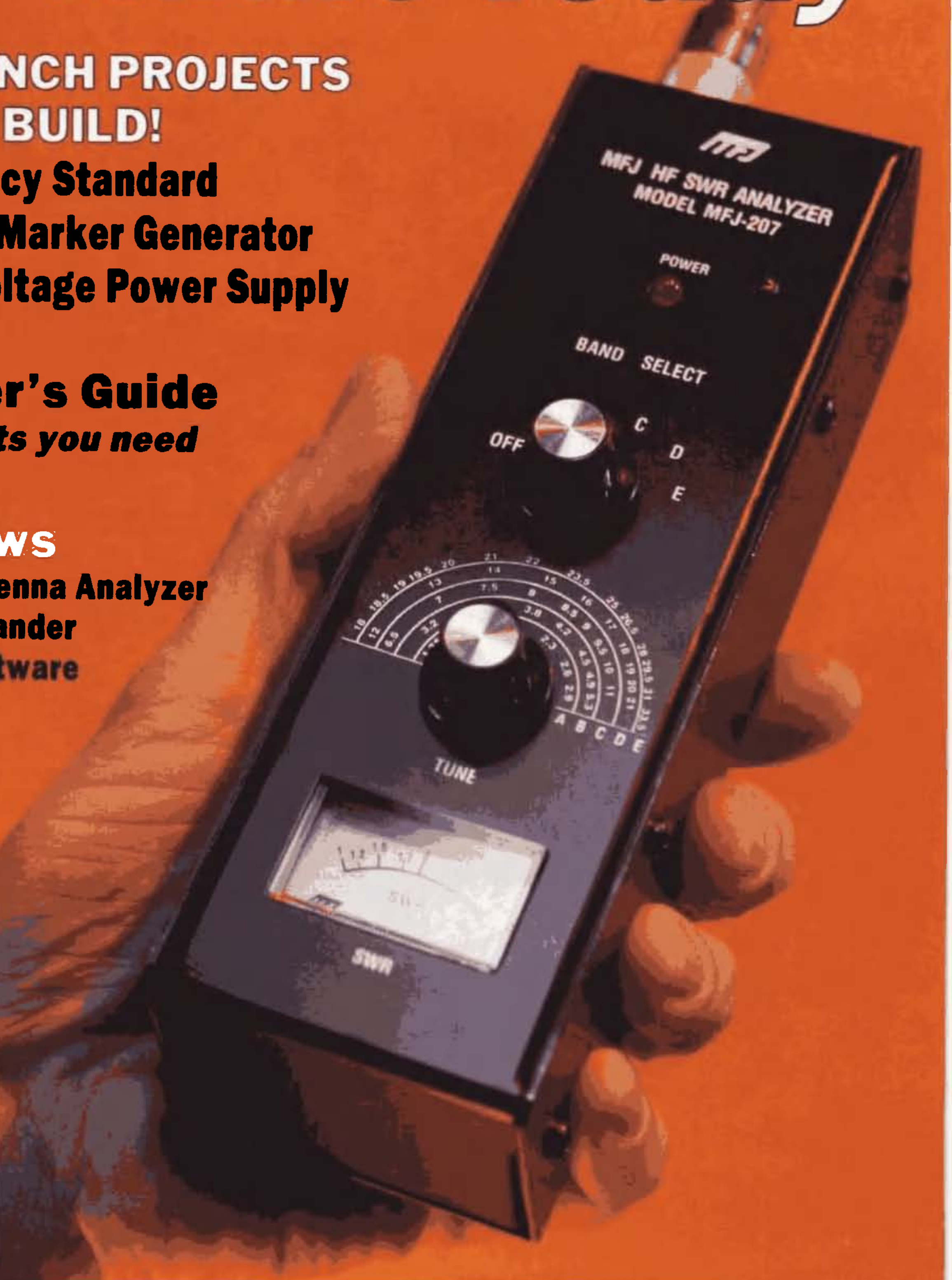

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LETTERS

Number 1 on your Feedback card

From the Hamshack

Barry isbelle KC4IDE, Richmond VA Wayne, I think you are tops! I've been a Tech for a couple years—back after being dumped by ARRL's "Incentive Licensing." The team here in Richmond has graduated 60+ Novices in the last year! Most instructors are Techs. Keep pushing us to give back to the hobby that gives us joy.

John Devon KI6DQ Okay, I'll subscribe! *73* features superior writing and a forward-looking attitude, without forgetting radio's past. Why is there so much "history" between you and the ARRL? And how can ham radio compete against computers and BBSs?

The League? I've been on their case to be more responsive to us members for 40 years. . . and they've been hating me for speaking up for 40 years. . . Wayne

Steve Baumrucker WD4MKQ The Nov. Fire-Ball and QRP articles were both fun and exciting. It is sad that in this age of illogic a man with such reasonable views should be cast as "an unreasonable man" (by himself, no less). Your editorials are consistently stimulating. I give *73* credit for prompting me to start a ham radio club at the local middle school. It is a small contribution, but "the journey of 1000 miles begins with the first step."

Fine, Steve. Now how about some pictures of your club?. . . Wayne

Paul Adams WB5EVO Thanks for your inspiring editorials and a great ham magazine. I've been licensed since 1971, and you've talked me into trying just about every phase from CW to ATV, including RTTY, SSTV, 160m thru 1296 MHz. Next is packet.

It's about time, Paul. . . Wayne

Bill Weir KA7DTN, Flagstaff AZ I've enjoyed your "Never Say Die," construction articles, and columns since the mid '60s. So how come your predictions and opinions always seem right? Most educational! Keep up the great work, gang.

I thought I was wrong once, but I was mistaken. . . Wayne

Tom Maynard, Hinckley IL About 20 years ago as a Novice I remember being amazed by Wayne's audacious attitude toward the ARRL. Now, having achieved enough success, I'm getting back into the hobby and Wayne ain't changed a bit. After trying a few issues of the other ham magazines, it seems as if *73* is the only one worth buying. Thanks, Wayne, for hanging in there and making my return a welcome one.

So stop sniveling and get your ticket. . . Wayne

Jim Blizzard AB4YC, Alabaster AL Keep up the good work! I've been a ham since March 1990, and have been buying your magazine off the newsstand since February. It's fun to read your "Never Say Die" each month.

It's a shame, though, that you have to beg, plead, and scream at hams to get off their amplifiers and get busy sharing this exciting hobby with non-hams. There are so many dimensions to ham radio—something for *everyone*.

Fortunately for me, there is an active group of hams where I work (at the phone company) who are interested in teaching others about amateur radio. That's how I became involved last December.

This fall we're going to have classes for both non-hams and hams interested in upgrading. The class will include traffic handling, packet, RTTY, hands-on CW, QSO practice, DXing and hints, and theory.

Just wanted you to know there are some of us on the go.

Gutless Dweeb 1NERD At the ARRL Forum at Boxborough it was suggested that hams could pass along their used magazines to their local school libraries, hoping kids might get exposed to 'em. Tom (W1 director) said it would be better to just purchase new League materials and donate them. Someone suggested the League should have had a booth at the Eastern States Exposition (a humongous fair), since it is near HQ. Price said no, the hams in California might want them to do the same and they can't be everywhere. So we're nowhere. Instead of being considered, every suggestion was argued and defensively put down with lame rebuttals.

This reader is scared silly that the ARRL may find out who he is, so I've withheld his name. How does the League generate such utter terror?
. . . Wayne

Gene Griggs N3IEW, Milford DE I used your 20 wpm tape and passed the 13 wpm test. I have been preaching your code system. I hope your shake-up of the music business is progressing—it's sorely needed. I spent 3 years on the road as a professional saxophonist and found it's not how good you are, but who you know that gets you the breaks. Love the new look of *73* and read your editorials first. Take care and watch your stress level.

Give me three years to turn the music business around and make it safe for talented performers. . . for a change. . . Wayne

Mike & Linda Simmons WB9CWE/KA9LWE As "900" telephone numbers are getting more popular, we were wondering if *73* might set one up and charge around $5 for a trial subscription. This might attract young Novices.

We're doing this with CD Review, *allowing readers to hear samples of new CD releases and to get a short message from me on what I've been doing. It takes a lot of activity to make a 900 number pay off, and I doubt we could get enough ham calls. . . but we'll set it up and see how it goes as soon as we can.*
. . . Wayne

Ryan Lughermo, Midland MI Uncle Wayne, I need your help again. I acquired an Apple IIc computer, but the way the damned ham industry is, everything is for the IBM. I cannot find software for all aspects of radio. In these days of much-needed youth in the ham ranks, how does a college student paying his own way get into this hobby without paying an arm and a leg? You bet I'm not going to buy an IBM (I can't afford it, anyway!) just to get into ham radio.

People need to stop and think. It's not just the code that discourages youth. How about the cost of everything? I didn't come from a family that bought whatever I wanted. Please voice the opinion to manufacturers if you get the chance. Your voice is much more respected in the ham world than just a 20-year-old college student's. Anyway, if any of your readers has any software for the Apple IIc computer, I need their help.

Keep on writing those great editorials that actually make people think, as it's the part of each issue I read first, even before the table of contents!

My quick scan of CompuServe's HAMNET data libraries turned up a few Apple programs: two CW trainers, two MUF programs, an antenna design program, and a toroid transformer design program. I haven't tried CompuServe's Apple-specific forums, so I'm sure with a bit of digging you'll turn up more.

In general, IBM is where the bucks are, comercially, but it's never stopped people from writing their own software and sharing it with others via on-line information services and BBs. If you see a need, why not fill it?

Nuge's Fearless Prediction: You won't do it!

My experience at Portable 100 *and* PICO *magazines (primarily non-IBM) has been that, while hams are often the most vocal about* wanting *certain programs, they're the least likely to actually* do something *about writing them. If you'd care to prove me wrong, you'd be doing your fellow Apple-type hams quite a favor. . . Nuge WB8GLQ*

Look in "Barter 'n' Buy." There is usually at least one ad for ham Apple software. Then, there's "RTTY Loop." Dr. Leavey WA3AJR has mentioned Apple software in some of his columns. You can contact him by letter or e-mail.
. . . Linda KA1UKM

Mike KB2JNB I recently finished your latest copy of *73 Magazine* and I thought it was great. I was reading the story about kids in ham radio and how much they enjoy it. Being a young amateur myself, I enjoyed reading about kids my age. I'd like to hear more about this in the future.

R.R. De Jongh WB7CPT, Bellevue WA Just a few lines to thank you for *73*, the only real ham magazine left! With the demise of the other New Hampshire offering, and the subsequent substitution of something less than satisfactory, I find that I worry somewhat about *73*. I see a trend in *73* that makes me somewhat uneasy—the "QSTing" of *73*! That is, the increasing number of columns and nontech articles and the reduction of tech and construction articles. I'd hoped that with the lack of competition, you wouldn't have to resort to all that filler, being swamped with tech material. What happened?

I still enjoy your editorials and agree with about 75 percent of them. . . .

While we put as many construction articles in 73 as possible, not everyone likes to sit down at the workbench with a hot soldering iron! We like to round out each issue with stories about what people are actually doing with amateur radio. We have special interest columns since there are so many facets of the hobby, and I think you'll find that many of these columns have construction hints and projects in them, in addition to our regular articles. What one person considers filler is another's filling (I prefer strawberry)!
. . . Bill WB8ELK

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Issue #364

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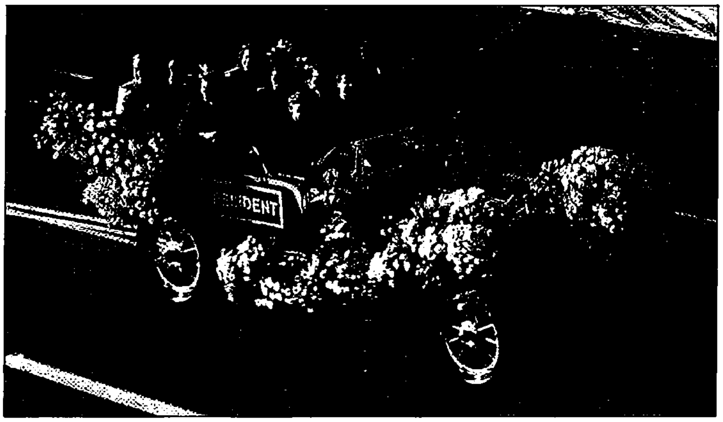

Work a Rose Parade float. . . see p. 46.

FEATURES

REVIEWS

Cover by Alice Scofield

Cover: MFJ's new antenna analyzer (the MFJ-207). Photo by Byron O'Brien.

DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

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Contract: Your fingerprints on this page are sufficient evidence to hold you to this binding agreement: You will make a New Year's Resolution to find at least one new ham in 1991, help him or her get a ticket, and see to it that he or she subscribes to *73 Amateur Radio Today*.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Your IOU Is Due

Let's see a quick show of hands . . . how many of you have gotten some fun out of amateur radio. . . sometime? Now, one more try. . . anyone actually learn anything of value as a result of the hobby? Come on now, none of that furtive, shifty-eyed, sullen silence baloney, I want to see some hands.

Okay, maybe you haven't done all that much in amateur radio. . . 90% of us haven't. Maybe I haven't been able (yet) to con you into getting out of your rut and trying packet, RTTY, SSTV, ORP, OSCAR or any of the other fantastic things there are to do in amateur radio, but even if you've only taken advantage of 1% of the fantastic electronic feast you have available to you, you have a debt to the hobby and it's now time to call that debt. Your IOU is due.

Yes, I see some of you looking uneasily around, hoping maybe someone else will do what needs to be done. I know what you're saying. You're, sigh, too busy with other things. And after all, hamming is only a hobby. Besides, you're tired. Yes, I know, over half of all licensed amateurs aren't active. . . haven't been in years. . . so what's the big deal?

"All right, already," you're saying about now. Now what does Wayne want me to do? And why, pray tell, should I bother? The hobby has had its ups and downs, but it's still here 45 years after we got back on the air after WWII. So what's the big deal now?

Well, to be truthful, it may be nothing at all. . . just another false alarm. But our gas gauge looks like it's finally running on empty. Maybe it's just broken. Still, if you've been active for very long. . . I've been on the air for 52 years now. . . you know our bands are in the worst mess they've ever been in. And I'm sure you're aware that we haven't contributed much in the way of service or technology to pay for the rent on our bands in the last 25 years.

It takes youngsters to make a revolution. It's always the students who bring things to a head. Alas, we have almost no kids in amateur radio anymore, so all that's left is us old-timers. No wonder we haven't had a revolution yet.

A corporation which so mismanaged its assets as the League has ours would be facing takeover bids. . . or at least a stockholder revolt. If you're a member of the ARRL, you're a stockholder. Say, is Wayne "bashing" the League again? No, not yet, but I may. . . I may.

Three Main Problems

In case your memory is short, let's review what's broken and needs to be fixed. Yes, I know I've written about all this before. . . so what are they? (1) We need to clean up the messes we've allowed to build up on our bands. (2) We need to get serious about attracting young new hams. (3a) A WARC is coming next year in Madrid and we're woefully unprepared to do anything but spend a lot of money sending over League vacationers. (3b) Followed by a Geneva WARC in 1993, for which we're equally unprepared except for ARRL hotel reservations.

Those are the problems. Now, how about solutions? Obviously there isn't much you can do personally about these miseries. There isn't even much I can do as an individual. . . other than try to get as many amateurs as possible to understand what's going on and how to go about fixing things.

The fix is both easy and difficult. The easy part is your voting in new ARRL directors in the next election (they're re-elected every two years). The difficult part is trying to convince hard-core League members that there's anything wrong. Oh, they're aware of how bad our bands are, but they seem to expect the FCC to clean things up, not the League. Self policing? No, they don't think they recall anyone promising the FCC anything like that.

These old birds get upset when someone tries to tell them that the FCC views us as a royal pain. They vaguely recognize on some level that we're keeping commercial interests from using billions of dollars of desperately needed frequencies. But heck, we've always had 'em. They don't like to think about the commercial pressures to provide more radio services. They know that money talks, but haven't really figured out what this means at the ITU or with our government in Washington.

If you're an ARRL member but don't want to "get involved" you can just be sure to not vote for the incumbent director in the next election. If you're a member and feel you owe more to amateur radio than one vote you'll start looking for someone to get behind and run for director. They have to have been a continuous member for at least four years and not be involved with the ham industry. It'll be a plus if they have some business experience, something which is sadly lacking with far too many current directors.

If you're not a member you can try to get your ARRL friends and fellow club members to wake up and smell the mess.

Should you join the League and try to fight from within, as they so highly recommend? You have ten times the power to be heard *before* they get your money. Once they have it, you've lost your leverage. If they show some signs of actually accepting their responsibility to protect our hobby, then they're worth anything they have the guts to charge.

As a 50-year League member I really hate the way they've allowed our bands to deteriorate. For instance, they should have cleaned up the KV4FZ and K1MAN messes long ago. And what happened to their promise to bring in 50,000 new hams?

And how many Third World country leaders have ARRL representatives visited recently in preparation for WARC?

Your vote for a new director in your division will get the ball rolling. It'll let 'em know they have to do more than just spend your money. You demand some service for your dues. You owe amateur radio this for the benefits it's brought to you. . . and for those it's made available, even if you haven't enjoyed them.

What If I'm Wrong?

As the old saying goes, I thought I was wrong once, but I was wrong about that. Let's suppose, though, that this time I'm wrong. . . that our bands are peachy. . . a model of which we can be proud and not one that commercial interests can exploit. Let's suppose that we really aren't just a bunch of crotchety, quarrelsome old men, largely retired, enjoying a fun hobby in our old age, paid for by the general public and preventing them from getting communications services they'd pay billions to get. Let's suppose that we really do have thousands of kids getting licenses, even though we don't see them at hamfests or club meetings, or hear them on the air. . . and they haven't shown up on the FCC statistics.

Let's suppose that the Third World countries, the ones who have the most votes at the ITU, aren't mad at past visiting American and European hams who have flaunted their rules. Let's suppose they are aware of the enormous benefits amateur radio could bring to their country, even though no one has ever mentioned it to them. . . and that they will be happy to give up their claims for shortwave broadcasting frequencies and other radio needs. Let's forget that since their telephone systems are almost nonexistent most businesses have to use radio communications, for which frequencies are desperately needed. I've mentioned all these things many times before and most of you have forgotten them, so one more time should be easy.

Okay, then our hobby is hunky-dory and I'm a gloom and doom curmudgeon for even suggesting the ARRL has shirked its responsibility to manage things. Even so, what's the possible harm if you elect a new director? One maybe with some serious business and marketing experience? Heck, maybe even someone who hasn't been an ARRL official for the last twenty years. What will it hurt?

Now, if that's ARRL-bashing, please advise how you figure that. And have enough guts to sign your call.

Your Biggest Thrill

When I asked if you've ever had fun with amateur radio, what came to mind? Think back. What was your most exciting ham experience? I've asked many hams this and gotten some fascinating stories. Now I'm asking you, knowing the *73* readers will enjoy your experience as much as I.

How long should the story be? As long as it takes, but if you run off at the word processor our editors will cut you down to size. If you can send a floppy along with the hard copy, so much the better. Don't forget a picture of yourself too, just in case we think the readers will enjoy your story.

Most of my truly exciting times have been while on DXpeditions. I'll never forget a minute of any of 'em. On my first, to Navassa in 1958, it was one adventure after another. First it was weathering a hurricane at sea. . . then almost crashing on a coral reef. . . then almost getting shot by the Haitian police. . . then having to dive in shark-infested wa-

Continued on page 73

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Photo A. At the 1990 Space Symposium in Houston, Texas, the AMSAT Board of Directors presented Andy MacAllister WA5ZIB with an award for promoting amateur satellite operation through his "Hamsats" column in 73 Magazine. *See his report on the symposium in this issue!*

In February, Time's Up

Last summer the FCC requested 20-meter nets involved in frequency and operating disputes to come up with their own ideas to solve the problem. By late fall, five net managers had responded and others were asking for more time. The FCC set a deadline of February 1, 1991 for those nets to present their ideas and plans. The hope is that the amateurs involved will be able to solve their own problems, otherwise the FCC might be forced to act.

The ARRL states that the three main areas of dispute are resolvable by enforcement of existing FCC regulations. These areas include specific illegal activities: third-party traffic when there is no third-party agreement between countries; malicious interference; and one-way broadcasts which go beyond accepted norms for transmission on the amateur bands. If the amateurs cannot engage in reasonable discussions to solve these matters among themselves, the FCC may be forced to develop and enforce restrictive rules and regulations that would hurt the entire Amateur Radio Service. TNX *B-N-T Bulletin, Vol. 19, Issue 10.*

W1AW Packet BBS

The ARRL has reinstated its packet radio BBS, W1AW-4, after more than a year off the air. The system uses Kenwood radios, Kamtronics TNCs, MSYS multiconnect BBS software, and a Tandy 1000, donated by Tandy.

The system is currently on 145.01 MHz with a backbone for forwarding on 221.05 MHz. The system is primarily for dissemination of ARRL bulletins and will not exchange other bulletins (such as NEBBS or ALLBBS types). Users are requested not to make W1AW their "home" BBS. TNX *Zero Beat*, Nov. '90 issue.

Pays for Itself

MARS is saving soldiers and their families $5.2 million per year, and the Army $31.5 million, according to the U.S. Army Information Systems Command in Fort Huachuca, Arizona. Robert Sutton, Chief of the Army's Military Affiliate Radio System (MARS), says that these statistics, compiled before Desert Shield, could now be higher. Thirty-three Army MARS stations are operating in Saudi Arabia, making about 150–200 phone patches a day. "Army MARS operators have also processed over 4,200 MARS-grams," says Sutton. The MARS network consists of 233 military and 3,800 HF amateur radio stations.

The primary purpose of MARS, dating back to 1925, is to serve as an alternate means of communication during emergencies. For example, in recent years, MARS volunteers participated in emergency communications during both the San Francisco earthquake and Hurricane Hugo. During peaceful times, MARS contributes to the considerably important task of maintaining the morale and welfare of troops and their families. TNX Robert Sutton and Diana Hawkins.

Callsign Changes

It seems there is not a limit to the number of times a licensee can change callsigns, says Ray Adams N4BAQ of the Western Carolina ARS-VEC. A new callsign is available to any licensed amateur for the asking.

The FCC has always had a policy of issuing another callsign in exchange for any callsign the licensee considered obscene. Showing that a callsign is obscene, however, may depend on personal perception and interpretation. To avoid being accused of favoritism, the FCC changed the policy to cover the issuance of a new callsign to any licensed amateur who asked.

The licensee cannot choose what the new callsign will be, however; the block it's drawn from is determined by the class of license the applicant holds at the time of filing. TNX *The Magnolia Report, Vol. III, No. 10.*

Nomadness at WESCON/90

Technological wizard and writer Steve Roberts N4RVE, who has contributed many articles to *73 Magazine* in the past three years, appeared at WESCON/90 in the Anaheim Convention Center last November. Roberts has spent the last seven years combining eclectic technology and interests—ham gear, computers, solar power, bicycles, and a love of writing and traveling—into a working lifestyle of "nomadness." As a high-tech nomad, N4RVE has computed and hammed across America, first from his Winnebiko, and now from the Behemoth, his new recumbent bicycle.

After seven years, Nomadic Research Labs boasts well over 100 corporate sponsors, such as OrCAD, Hewlett-Packard, Apple Computer, and Sun Microsystems. From the Behemoth's computer systems, Roberts does bike-top publishing, word processing, satellite operation, sound editing, and graphics. TNX Kathryn Botsford of OrCAD.

A Ham At Last!

"I'm finally a licensed radio amateur, and one happy ham!" After 25 years in network television, well-known meteorologist Gordon Barnes is on the air. With the help and encouragement of many ham friends, Barnes began studying in the fall of 1989, and received his license in early 1990. His first contact was with Dave Jackson G0EGG in England.

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Photo B. A MARS operator coordinates a radio net with affiliate MARS members.

QRX . . .

Continued from page 7

Gordon KC4OCA became interested in radio while growing up in Bermuda during World War II. A long-wire and Hallicrafter S-38 receiver kept him and his brother, Pete, informed on world events. Before long, they had raised an antenna farm among the cedars. Says Barnes, "The radio served as an educational device. This is how my brother and I learned about sports . . . they were broadcasting into countries where our men were fighting, and knowing that many foreigners would be listening for the first time, they took time and pride in explaining the game. . . . It was just great!"

Photo C. Gordon Barnes KC4OCA, a ham at last!

Barnes, who worked with CBS, WUSA-TV, and WFLA-TV, had his own syndicated weather network, and he also served as a weather consultant for many private and publicly-owned companies. A "weatherholic" whose predictive talents show the highest rates of accuracy, Barnes feels that nearly every service and product is affected by the weather. TNX Katherine S. Barnes.

A Tale of Two Stations

Stations WWV and WWVH are both operated by the National Institute of Standards and Technology. They both broadcast the time of day and standard time intervals, maritime storm information, omega reports, and geophysical alerts. Both broadcast AM (DSB) 10 kW on 2.5, 5, 10, and 15 MHz, with WWV also on 20 MHz. WWV is located at Fort Collins, Colorado, and WWVH is located in Kauai, Hawaii. All of WWV's antennas are omnidirectional half-wave dipoles, while WWVH has half-wave phased verticals with a cardioid pattern aimed at the west.

WWV's announcer is male and WWVH's announcer is female. On WWV, there's no tick on the 29th and 59th seconds; on WWVH, it's silent at seconds 00 and 30. Both stations broadcast a 440 Hz tone (the musical note "A" above "middle C"), for chart recorders and other automated devices, once each hour—on WWV, 3 minutes past the hour; on WWVH, 1 minute past the hour.

For propagation forecasts, hams can use the geo-alerts broadcast from WWV only at 18 minutes past each hour and updated every three hours at 0000, 0300, etc. These alerts contain information on the solar flux index measured daily at 1700 UTC in Ottawa, Canada; and the current K-index (distrubance of the earth's magnetic field) along with past and predicted 24-hour activity.

If you can't receive WWV on your rig, you can call (303) 499-7111 anytime and hear the same information. For more information on WWV and WWVH, write The National Institute of Standards and Technology, 2000 East County Road 58, Fort Collins CO 80542. TNX *Kettle Drums, Vol. XVI, Nos. 10 & 11.* Also, the Broward Amateur Radio Club Bulletin of October '90 (Pembroke Pines, Florida) has an excellent article, "WWV Solar Activity Reports," by Wally Orlidge W3PAE.

WARC Proposals

The FCC released its Second Notice of Inquiry concerning possible recommendations it might make at the 1992 World Administrative Radio Conference in February 1992. Before compiling this report, known as General Docket 89-554, the FCC considered comments on frequency spectrum needs from over 50 organizations, including the ARRL, NASA, Motorola, UPS, the Voice of America, and the National Association of Broadcasters. Three recommendations affect amateur radio frequencies that WARC has the power to reassign.

First, the FCC proposes that the amateur radio 40 meter band be shifted to 6900–7200 kHz (international broadcasters would get a separate 7200–7400 exclusive allocation, possibly to 7525 kHz). Second, the FCC proposes that Low Earth Oribiting Satellites (LEOs) use 930–931 MHz uplink and 420–421 MHz downlink. Third, the FCC recommends a satellite/digital sound service that would provide quality, wide-area service for mobile radio receivers; it is looking at 728–788 MHz, 1493–1525 MHz, and 2390–2450 MHz (in the amateur spectrum).

Further changes are probable before WARC '92. At WARC, each nation will have one vote. In the past, FCC recommendations have carried weight with WARC delegates. WARC agreements must be ratified by the U.S. Senate to become effective in the United States. TNX *Balanced Modulator.*

Satellite News

OSCAR-13 may only have two more years to orbit the earth . . . or, according to others, its orbit will correct itself due to factors not entirely known. Many believe AMSAT will come up with a replacement. The 1995 launch date for Phase III for a geosyncronous orbit hamsat, operable 24 hours a day, has been postponed indefinitely due to the high cost of such a mission. AMSAT has sent out a notice via ARRL requesting that, due to inadequate solar panel illumination, the OSCAR 10 transponder not be used until further notice. (Check, as this may have changed by the time this magazine is on the newsstands.)

Photo D. Guardian Angel Julio Rivera learns more about ham radio after delivering some last minute pointers to Joe Fairclough WB2JKJ, president of the Radio Club of JHS 22. Last Halloween, the "22 Crew" initiated "SAFE HOME" to escort club members and other youngsters to and from school. They are coordinating the operation on a Manhattan 220 MHz repeater. With Angels for advisers, the Crew will make it safe for hundreds of young people who want to be hams.

High Precision Frequency Standard

Use your TV set as a laboratory standard!

by Gardner Johnson

One of Murphy's laws of electronics is that "no other display looks as convincing as a digital display, no matter how wrong it is." Your handheld or laboratory counter or digitally-tuned communication equipment can easily become an example of this, unless it has been calibrated recently.

The problem is that the precision of such equipment can be no better than the precision of the internal time base. When the time-base frequency drifts, all of the indications or tuning frequencies drift in direct proportion. Almost all counter-type instruments use a quartz crystal-controlled oscillator as the time base, and unfortunately, they do drift with time as the crystal ages. Drift also results from changes in crystal and component temperatures, supply voltage variations, and the aging of other frequency-determining components.

The changes may not be significant for some equipment, such as a digitally-tuned AM radio, but a seven- or eight-digit counter or a VHF communications system is another story! An independent source of precisely known frequency is needed to verify the accuracy of, or to calibrate, the digital equipment. In many cases, the same is needed for analog equipment, such as in calibrating the sweep circuits of an oscilloscope. Better yet, this frequency source should be widely available and cheap.

TV Network Standards

Every color TV receiver tuned to a program originating at one of the four major U.S.A. networks has at least two such frequencies present internally. One of these is the color-burst frequency of 3.57954545454 MHz (3.58 MHz). The other is the horizontal sweep frequency of 15.7342657343 kHz (15.7 kHz). In the early days of color TV, they decided each network would phase-lock these two frequencies to use the 5 MHz output of a rubidium frequency standard at the network's master control station to ensure the desired accuracy of color reproduction. The rubidium standards have a rated maximum frequency drift of one part in 10 to the 11th power per month. In perspective, this is approximately 10,000 times better than the typical received accuracy of the WWV shortwave signals (the equivalent of one second in 31 centuries!)

The remarkable thing about the simple equipment shown in Photo A is that by taking advantage of the characteristics of phase-locked loops (PLLs), it creates a one-megahertz calibration signal having essentially the same long-term precision as the network rubidium standards. Adding decade dividers to the unit permits measurement of the frequency differences among the four major network rubidium standards! Since the standards are of unequal ages, they differ by several parts in ten to the 11th power. The only other equipment used to accomplish the measurements, besides an ordinary color TV receiver, was a very well-aged (1965) H-P 5248L electronic counter purchased complete with a time-interval plug-in for $37 at a ham swap-meet.

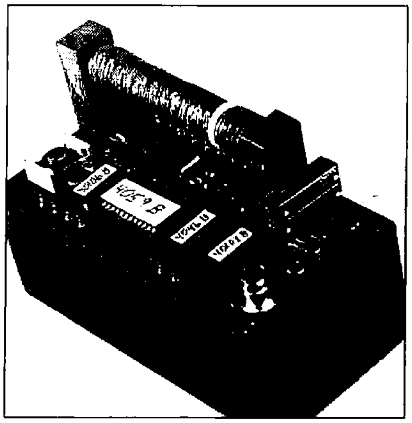

Photo A. The high-precision frequency standard in operation. (place the loopstick near the TVs horizontal output transformer)

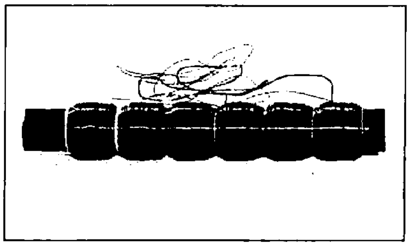

Photo B. The ferrite loopstick antenna is designed for maximum pickup of the TV set's 15.7 kHz horizontal sweep frequency.

Programs from ABC, CBS, and NBC are frequently interrupted by locally originated commercials which do not have rubidium frequency standard precision. It's unfortunately necessary to keep one eye (or ear) attentive to their program material so that the interruptions can be excluded from any measurement periods. PTL transmissions are rarely interrupted and maintain a frequency near the mean of the other networks.

Just a PLL

The circuit I'm going to describe is a simple PLL. It picks up a sample of the horizontal sweep signal of a color TV receiver that's tuned to a network program, then phase-locks a voltage-controlled oscillator (VCO) to the sample, using the frequency ratio 4004 to 63. This yields the desired, very precise one-megahertz output frequency.

Figure 1 is a block diagram and Figure 2 is the schematic for the simplified frequency standard. The 15.7 kHz pickup coil is a ferrite loopstick antenna tuned to the horizontal sweep frequency of an operating TV receiver. By picking this signal up magnetically from outside the TV set's cabinet, direct connection to the wiring inside the cabinet is avoided. This is a major safety consideration, as it rules out use of the much weaker 3.58 MHz signal. Many TV receivers have the chassis connected to one side of the power line—you guess which side! The resonant loopstick circuit has a Q of over 400, so it also acts as a very effective filter for the undesired signals prominent in or near an operating TV receiver.

The 15.7 kHz signal picked up by the loopstick is an excellent sine wave for eliminating other frequencies, but it's not ideal for operating the digital circuits which follow. The Schmitt buffers square up this sine wave without appreciably loading the tuned circuit, and they drive the CMOS 40103 divide-by-63 stage which follows.

The 40103 divider has eight flip-flops which can be arranged to divide an incoming pulse train by any number from 2 to 255. As used here, it divides the 15.7 kHz square wave signal from the Schmitt buffers by 63 to provide the 249.750249750 Hz (250 Hz) "reference signal" to pin 14 of the 4046 phase detector which follows. 250 Hz was chosen as the reference signal because it's the greatest common divisor of both the high precision 15.7 kHz signal from the loopstick

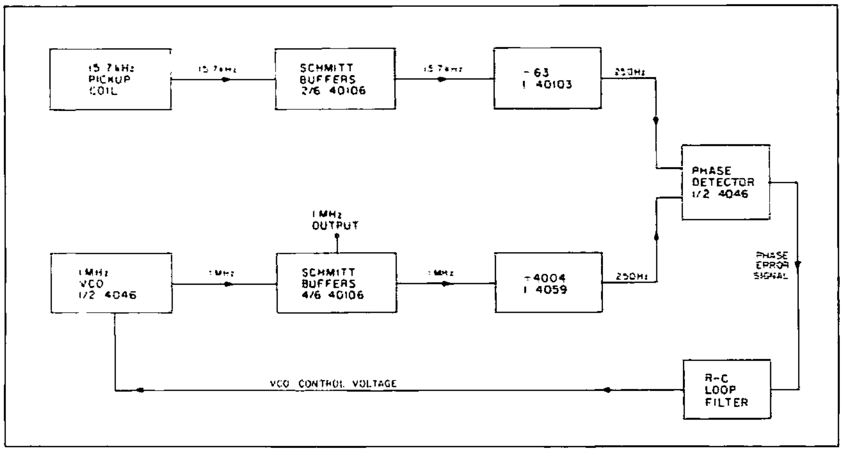

Figure 1. Block diagram of the frequency standard setup.

and the one-megahertz VCO signal that provides the unit's output.

The one-megahertz VCO is one of a number of separate functions physically located on the 4046 phase detector chip. The 4046 VCO is a well-engineered square-wave RC oscillator with useful harmonics up through the shortwave bands. You can make it oscillate at any frequency from less than one hertz to over two megahertz by choosing the proper external capacitor, two resistors, and a control voltage.

The capacitor, C6, and one resistor, R5, determine the frequency of oscillation when the control voltage equals the supply voltage. Resistors R7 plus R8 determine the frequency of oscillation when the control voltage is zero. By varying the control voltage between zero and the supply voltage, you can vary the oscillation frequency linearly, from the lower to the higher of these two frequencies.

For the present application, the capacitor and the three resistors have been chosen to yield an oscillation frequency of one megahertz when the control voltage is equal to half the supply voltage. Any deviation from the desired one megahertz is then corrected by a corresponding change in the control voltage.

The one-megahertz output of the VCO is passed through two Schmitt buffers for isolation, then fed into a 4059 divider. The versatile 4059 IC can be connected to divide an incoming pulse train by any number from 3 to 21,327. Used here, it divides the one-megahertz input from the buffers by 4004 to provide the 250 hertz "signal input" to pin 3 of the phase detector. If the VCO frequency shifts ever so slightly up or down from one megahertz, the 250 hertz signal frequency will increase or decrease in proportion.

Phase detector 2 of the 4046 compares the arrival times of the leading edges of the two 250 hertz signals, and outputs a signal that, after filtering, varies with the fraction of a cycle by which the two leading edges do not coincide. When the edges match perfectly, the filtered DC output is equal to half the supply voltage. If the one-megahertz oscillator drifts lower in frequency, the pulses from the 4059 divider will begin to arrive later, and the filtered DC output of the detector will increase, again in proportion. By applying the filtered output of the phase detector to the control voltage terminal of the VCO, the frequency of the VCO can thus be locked to the frequency of the TV receiver horizontal sweep. Although this part of the operation is analog in nature, it is enclosed within the overall digital loop, which maintains the necessary system long-term precision.

The RC filter performs two important functions. First, it filters out the 250 hertz (and any other) noise present on the output of the phase detector. If this noise reaches the VCO, it would frequency-modulate the VCO output, thereby degrading the short-term accuracy of the output signal. The long-term accuracy, however, would not be affected.

Secondly, the circuit includes a feedback loop around the VCO. This loop requires the usual amplitide and phase stabilization if it is to lock up very rapidly with no tendency to overshoot or oscillate. The simple 4-element filter used here does both jobs well, and a nearby "Hi-Fi" broadcast band receiver can detect no modulation on or near the one-megahertz output signal.

Building the Circuit

The prototype was built on a leftover scrap of pad-per-hole circuit board, but ordinary perfboard works just as well. I cut the board to form a new cover for a 3" x 6" plastic project box that encloses the wire-wrap connections, and I used turret lugs for mounting the few small parts on the top of the board. The lugs were staked in place, but press-in plastic based terminals are a good alternative.

Parts layout is not at all critical, except that the grounded end of the loopstick should be located near the end of the unit so that you can put it against the back of a TV set, if necessary, for maximum pickup. The loopstick should also be located at least an inch away from other metallic objects, as they may degrade its Q. The loopstick in Photo B is supported by inserting the ends in holes drilled halfway through two phenolic blocks. *[Ed. Note: An etched and drilled PC board is available which should help ease the construction process (see parts list).*

If you decide not to use the PC board layout, you can wire-wrap everything onto perfboard. Wiring is noncritical, except that the RC filter leads should be connected directly to the 4046 socket pins in order to keep the VCO control signal as clean as possible. Wiring was fast and easy, using 30 gauge insulated wire-wrap wire and an inexpensive hand-wrapping wand. One ancient truth was relearned the hard way, however: Never, never, never buy wire-wrap sockets with short two-wrap pins, no matter how high the quality or low the price!

The equipment only requires about 12 mil-

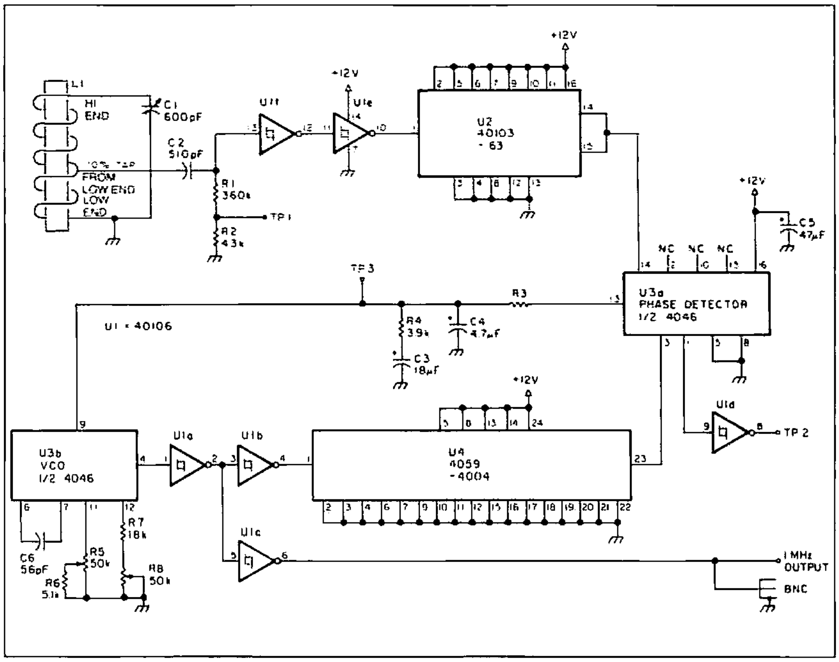

Figure 2. Schematic for the frequency standard.

liamperes (mA) of well-filtered, regulated 12-volt DC power. A 1.2 ampere wall-plug computer surplus power supply (used for the prototype) is 100 times larger than you need. You can easily assemble a small supply, using the many plans in back issues of *73 Magazine* if surplus is not available in your area. The supply voltage doesn't have to be exactly 12 volts DC; you can use your shack's 13.8 volt DC power supply as well.

Checkout

Recheck your wiring carefully, then apply the 12-volt DC power. If there's no smoke, and power appears only on the correct socket contacts, turn the power off. With the power off, insert the four ICs. To prevent ESD damage, keep one fingertip on the ground terminal while handling the ICs.

Set the two trim resistors at mid-scale and reapply the power. Next, place the unit close to the back of an operating color TV receiver and connect a 50 microampere (μA) DC meter from TP-1 to ground. (Almost any multimeter will serve if set on its lowest voltage or current range.) Adjust the trimmer capacitor for the peak meter indication. The peak will be very sharp due to the high loopstick Q.

Explore the vicinity of the back and sides of the TV receiver with the unit to locate the spot providing maximum pickup. Next, disconnect the sensitive meter and connect a 0–15 volt meter from TP-2 to ground. If the loopstick is picking up enough signal to operate the phase detector, the voltage at TP-2 will be about 0.2 volts.

Excessive loopstick signal could overload the buffer, so slowly move the unit away until the TP-2 voltage jumps to 11.8, which indicates insufficient signal. Move the unit about an inch closer to the point of maximum pickup, and leave it there. You can simplify this part of the checkout procedure if you have an oscilloscope. Connect the scope from the tap on the loopstick to ground, adjust the capacitor for maximum signal, and position the unit for 12 volts peak-to-peak. This gives the design center condition (when using a 12 volt supply), but the unit will operate satisfactorily over a wide range of loop signal strengths as long as the TP-2 voltage remains below half a volt.

The unit should be providing a very good

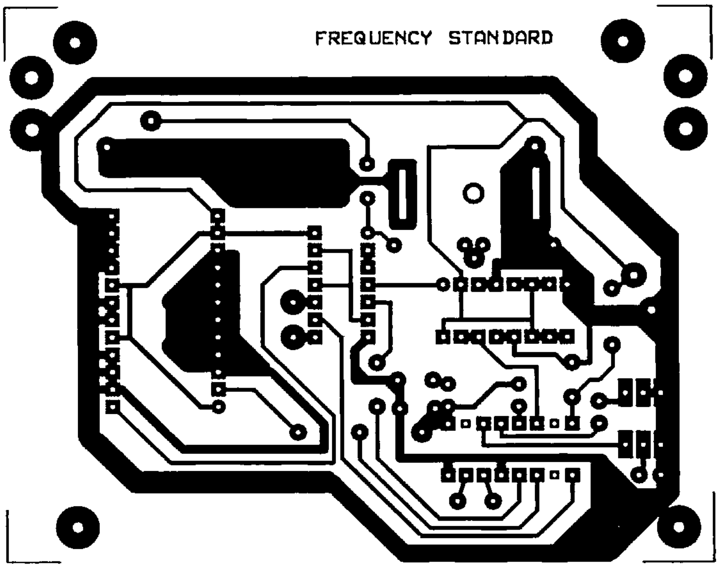

Figure 3. PC board foil pattern.

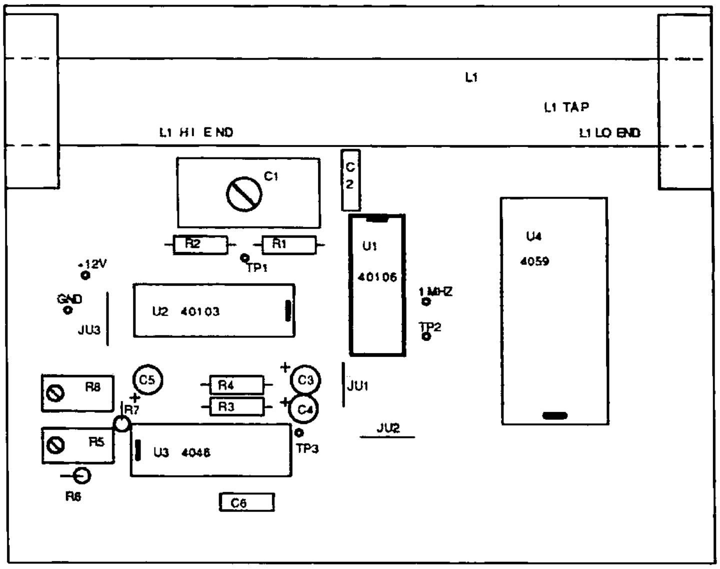

Figure 4. Parts Placement.

one-megahertz output signal at this point, but the trimming resistor adjustments should still be optimized for the particular 4046 in use, since the VCO sections vary a great deal from one 4046 brand to another. To do this, connect TP-3 to +12 volts with a clip lead and adjust R5 for an output frequency of roughly 1300 kHz. Next, connect TP-3 to ground and adjust R8 for an output frequency of roughly 700 kHz. Refine these initial settings until the two frequencies are equally spaced above and below one megahertz. If a counter is not available, you can measure these frequencies by tuning them in on a broadcast band receiver.

Remove the clip-lead and listen to the one-megahertz signal on the broadcast band receiver. If there is hum modulation, the most probable cause is hum on the output of the power supply. If there is 250 hertz modulation, the loop filter is at fault, possibly due to dried-out or leaky capacitors or ground loops in the filter wiring. A spectrum analyzer is even better than a broadcast band receiver for troubleshooting, but if you have a spectrum analyzer, you undoubtedly need no further suggestions!

The VCO frequency-control voltage at TP-3 is between 2 and 10 volts during normal circuit operation. If the TP-3 voltage drops to a few tenths of a volt, it indicates that the phase-locked loop is not locked. In that case, the uncontrolled output frequency will drop to around 700 kHz. It's good to give the TP-3 voltage a quick check a minute or two before making an important measurement. TP-3 is a very high-impedance point, and leaking loop filter capacitors, or connecting an ordinary multimeter, will result in 250 hertz modulation of the one-megahertz output.

Loopstick Details

The later version of the loopstick antenna as shown in Photo B has lower distributed capacitance and higher Q than the earlier versions. It's wound on an Amidon R33-050-400 ferrite rod core, with ¼" clear at each end for mounting. The remaining 3½" are covered with a single layer of tape to reduce the distributed capacitance between the windings and the fairly conductive core. Since Litz offers no advantages in this application, the wire used was number 30 nylon enamel.

The winding was subdivided into six 300-turn, layer-wound sections in order to reduce the end-to-end distributed capacitance while keeping the turns close to the core. The tap is located 180 turns from the start of the first coil. The measured inductance was 203 millihenries (mH) with a Q of 32 at 1000 hertz and a DC resistance of 35.5 ohms at 25°C.

These values permit the coil to resonate with the largest generally available adjustable trimmer capacitor without need for additional paralleled fixed capacitors. These values also permit taking the output to the buffer from only 10% of the total turns, which reduces the effect of buffer loading on the circuit Q by a factor of 100. Caution! R33 cores are fairly brittle. The completed loopstick is also commercially available if winding 1800 turns of wire is not for you (see the parts list).

Parts List

Capacitors

C1	700 pF compression mica trimmer (Circuit Specialists# 4215)
C2	510 pF to 1,000 pF, glass or mica
C3	18 µF, 50V tantalum such as M39003-01/2379*
C4	4.7 µF, 50V tantalum such as M39003-01/2368*
C5	47 µF, 20V tantalum M39003-01/2295
C6	56 pF to 68 pF glass or silver-mica

*20V parts would be satisfactory if of the correct capacitance.

Inductors

L1	200 mH (minimum) ferrite loopstick (see source #7)

Resistors

R1	360k ohms
R2	43k ohms
R3	5.1k ohms
R4	3.9k ohms
R5,R8	50k-ohm/25 turn adjustable trimmer (Circuit Specialists part# 950W50K, Mouser part# 594-64W503 or Digikey part# CEG54)
R6	5.1k ohms
R7	18k ohms

Semiconductors

U1	CD40106B CMOS hex Schmitt trigger
U2	CD40103B CMOS 8-stage presettable synchronous down counter
U3	CD4046B CMOS micropower phase-locked loop
U4	CD4059B CMOS programmable divide by N counter

Note: The "A" versions of all four ICs can be used, but they are more susceptible to ESD damage.

An etched and drilled PC board is available for $6 + $1.50 postage/handling from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

Sources

1. Radio Shack.
2. Amidon Associates, 12033 Otsego St., North Hollywood CA. (For ferrite cores; be sure to request a catalog.) Tel. (213) 763-5770.
3. Circuit Specialists. Tel. (800) 528-1417.
4. Digi-Key Corporation. Tel. (800) 344-4539.
5. Mouser Electronics. Tel (800) 346-6873.
6. Newark Electronics. Tel. (312) 784-5100.
7. Magnetic Component Engineering, Inc., 11379 Playa St., Culver City CA 90230. (Coil winding and completed loopsticks; part no. 74690 will be a duplicate of the loopstick in Photo B. Price is $14.95.) Tel. (213) 398-4761.

PLL Possibilities

The capabilities of the PLL create at least two opportunities. The first is for entrepreneurs to market completed units or kits. The second is for the ex-NBS NIST and the FCC to jointly persuade or require all TV networks to upgrade their color-burst frequencies to cesium beam precision.

Regarding the first, here are some possible design variations:

1. Add a divider chain to make numerous lower output frequencies available. Use synchronous dividers to minimize phase noise. Extend the chain to 0.001 or 0.0001 hertz. Add an FET buffer, a meter, and a switch for monitoring TP-1 and TP-3, and an LED indicator for TP-2.

2. Use a quartz crystal VCO (VCXO) in place of the 4046 RC VCO, again to minimize phase noise. Use a 10 or 100 MHz crystal to facilitate calibration of counters having short sampling periods. Use 74AC or 74F dividers to follow a 100 MHz VCXO. Use a 25 MHz fundamental VCXO and two doublers if the 100 MHz fifth-overtone VCXOs give cost or reliability problems.

3. Start with a TV tuner and IF appendages. The 3.58 MHz color-burst signal can then be phase-locked to a one-megahertz VCO by using 88 and 351 dividers. The lock frequency then becomes 11.3636363636 kHz, which improves PLL dynamic performance and permits still better filtering of the phase detector output. Add decade dividers for the higher VCO frequencies.

Regarding the second opportunity: A dozen dividers added to the unit would provide the long-term precision available to every standards laboratory, research group, business, and individual user in the world for under $100 plus a color TV receiver. Cesium beam standards have a rated precision of one part in 10 to the 12th power, the equivalent of one second in 31,000 years, the world standards of time and frequency. Unlike rubidium secondary standards, they're believed to be free from aging effects.

At the network master stations, the rubidium standards could be replaced with cesium beam standards for about $33,500 each, small change in that world. But there are even less expensive approaches. NIST already maintains a bank of cesium beam standards to control the transmission of WWV. The 60 kHz WWV signal is not subject to the Doppler shift problems of shortwave signals; suitable receiver systems have been available for about $1,800. By phase-locking the rubidium standards to the 60 kHz WWV signal, ten times higher precision can be obtained. A third possibility would be for NIST to supply a pilot frequency for phase-locking via phone lines. A fourth, would be to do the same thing via satellite, and a fifth would be for NIST or another agency to supply the cesium standards to the networks as a service to government agencies, businesses, and even the taxpayers.

The Final Unit

The unit in Photo A was later modified by the addition of a chain of decimal dividers to enable measurement of the difference of the network standards (requires counting 100,000,000,000 pulses). The well-aged H-P 5248L was used in the time-interval mode, counting its own internal 100 MHz clock pulses for a time determined by the 0.001 Hz (or 0.0005 Hz) pulses from the dividers. This circumvents the counter limitation of a 10-second maximum count interval for direct frequency measurement. In the 1000-second interval, it therefore counted 10^{11} pulses. The display shows only the last eight digits of the count, but they are the ones of interest. The time interval plug-in had slightly different delays in the start and stop channels, but they were calibrated out by use of measurements taken at a series of shorter times.

The procedure was to take repeated counts on each of the four network stations in sequence. The differences in the averages for each station thus corresponded to the differences in the frequencies of their rubidium standards. Similarly, any drift in the average of each group of four readings would correspond to the aging rate of the H-P 5248L clock oscillator, although no statistically significant difference was found.

The most impressive thing about the whole effort was the way the data repeated time after time. The total number of PLLs in the overall system, from those in the rubidium standards to those in the measuring system, must have been quite large. The signals from three of the four networks had to travel either 3,000 miles over land, or to a satellite and back, for good measure. The amount of short-term phase modulation of the VCXO must also have been very small, because the overall standard deviation of the 100 trillion count samples averaged about three counts! 73

Gardner Johnson, recently retired from Hughes Aircraft's Radar Systems Division, may be reached at 3744 Wade St., Los Angeles CA 90066.

73 Review

by Bill Clarke WA4BLC

MFJ SWR Analyzers

The MFJ-207 HF and 208 VHF portables.

MFJ Enterprises, Inc.
Box 494
Mississippi State MS 39762
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TELEX: 53 4590 MFJSTKV
Price Class: MFJ-207, $100
MFJ-208, $ 90

Have you ever put up a dipole that was pre-cut to an exact length tor a specific frequency? Did it work as planned? Or, as in most cases, did you have to make so many trips between the shack and the antenna to check the SWR that you wore a path across the lawn?

Suppose you had a portable device you could take out to the antenna and make SWR tests on the spot? Think your life would be a little simpler?

Well, the folks at MFJ Enterprises—the manufacturer of all those neat make-it-easier-on-the-ham gadgets—have come up with two great boxes for testing antenna SWR. One, the Model 207, is for the HF spectrum of 1.75–30 MHz, and the other, the Model 208, is for the 142–156 MHz VHF user.

Both SWR analyzers are the same size and weight: 7.5 x 2.4 x 2.7 (HWD) inches and less than a pound. Both have an ON/OFF switch, frequency control, an SWR meter, and an SO-239 connector. They operate on a 9-volt battery or an optional (Model 1312) AC adapter. The latter might be fine for use in the shack, but I like the portability of battery operation.

A Test Run

Here at the new QTH of Radio WA4BLC, the antenna system has been slowly growing. Knowing that my wire antennas and VHF vertical are correctly set up (done the old hard way: In the shack—check the SWR, then back out and trim some more on the antenna, and back again), I decided to check the new SWR analyzers.

Using a short piece of RG-8X as a patch line, I connected the MFJ-207 (the HF version) directly to the Double Edged Sword's feedline, selected band B (includes 75–80 meters) and turned the unit's frequency control to find the lowest SWR reading. (The Double Edged Sword Antenna is a dipole system with legs cut for 40 and 75 meters, fed with one feedline.)

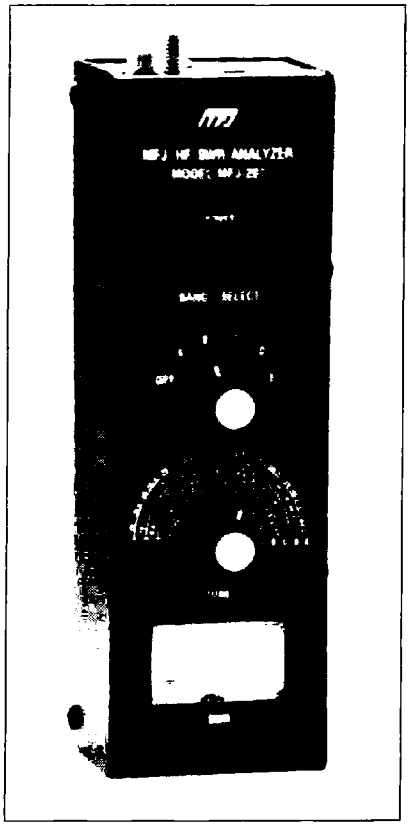
Once this reading was made, I tuned the receiver until I heard the 207's signal. The receiver accurately indicated the analyzer's frequency of lowest SWR. I repeated the process on 40 meters. The lowest SWR readings were exactly where they had been set last week.

This was an exercise in rechecking what I had already done (a known product) against the SWR analyzer (an unknown product). As both methods produced similar results, I am satisfied the Model 207 performs as designed.

Out of curiosity, I then connected the device to my Carolina Windom's feedline and tuned to see what would happen. Low SWR was indicated at many points over the HF spectrum. Some were inside the ham bands, others were not. All points were close enough to our bands to allow easy operation with a tuner.

Practical Operation

The test runs were done by tuning the 207's vernier dial, observing the built-in SWR meter, then pinpointing the 207's exact frequency on a receiver. The reason you must check the frequency with a receiver is that the vernier dial on the SWR analyzer is small and covers too broad a tuning range to be really accurate.



MFJ's SWR analyzers make proper antenna installation faster and easier.

Having seen the problem with the vernier readout, MFJ installed an RCA jack labeled RF OUT on the 207 (and 208) to allow direct connection with a frequency counter for a very accurate readout. This is great in the field, where no receiver is readily available.

Finding the SWR

The test run demonstrated how you would find the lowest SWR point for an antenna; however, the 207 can also be used to find an antenna's SWR at a pre-determined frequency. Connect the unit to the antenna being tested, set the vernier dial to the frequency desired (checking with a receiver or counter), and read the SWR.

If you have ever installed a multiband antenna, whether a 5-band vertical or a triband yagi beam, you know how very frustrating it is to keep running SWR checks from the shack. With the 207, you can tell directly from the antenna site (ground level for the vertical or on the tower for the beam) what the SWR will be at what frequencies. Then you can easily make adjustments before you tighten everything up.

Like the idea of tuning up your antenna matching device while not actually being on the air? The 207 can be set to your operating frequency and its signal injected into your tuner. Then you can adjust the tuner until the 207 displays a perfect 1:1 match.

The 207 worked great on my mobile antenna system, which consists of several Hustler resonators (coils) for the 75 and 40 meter bands. I had forgotten which coils were for what frequencies. Using the 207 I was able to quickiy identify the lowest SWR points (therefore the operational frequency) of each coil. It is also great for readjusting these ultra-sensitive antenna tips for new frequencies.

VHF Version

The Model MFJ-208 does for 2 meters what the 207 does for the HF band. It is identical in size, although somewhat simpler to operate as there is only one band to be concerned with

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on the vernier dial. Tuning indication is more accurate.

It worked splendidly for retouching my 2 meter whips and rechecking my V-2 vertical. Good thing the V-2 checked out OK, as it was already up in the air.

Just for the fun of it, I checked a couple of those famous rubber-covered dummy loads we all use on our HTs. I figured the readings would be similar to real-life HT operation, as the 208 is about the same physical size as an HT (ground plane?). The best SWR a famous gain-style rubber-covered antenna showed was 2.25, and that was at 147 MHz. A very short type showed an SWR of 1.3, but that was above the band by a couple of MHz. A factory variety was on the money for frequency at 146 MHz, but the SWR was 2.3.

These results came as no great surprise and only go to prove a point: I don't think any of the short HT-type antennas do as well as they should be doing. In past lab tests, using very sophisticated equipment, I had reached the same conclusions.

Mobile VHF antennas can get pulled out at the car wash, but the Model 208 will get you back on target quickly.

Likes

Portability. You can use it in the field, your car, or up on a tower.

Readability. The SWR meter is easily read.

Controls. All the controls operate easily.

Cost. The cost is reasonable, even in today's dollars.

Possible Improvements

The vernier dial on the 207 is not very accurate, but use with a counter makes the dial redundant. Additionally, the dial can be moved on its shaft for calibration purposes (which I did). The 208's dial is quite accurate, possibly due to its limited frequency coverage.

The instructions are adequate for operation, but they should have included information about the methods of charting antenna SWR by frequency, and instruction on how to use that information for making antenna adjustments.

Recommendations

Would I recommend the MFJ Antenna analyzers to my fellow hams? Yes, and it is too bad I didn't have them a few weeks ago when I was setting up my antenna system. They could have prevented the new path worn in the grass from the antenna field to my shack's door.

One last comment: These SWR analyzers provide a means of accurately tuning antennas WITHOUT transmitting any signals. In other words, they reduce air pollution, as well as making the hams's life a little easier. 73

Bill Clarke WA4BLC, who has reviewed a lot of equipment for 73 readers over the past years, has a new address. You can now reach him at RD#2 Box 455-A, Altamont NY 12009. Says Bill, "I enjoy reviewing equipment I can get excited about."

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0552G	50-54	25	400	.6	15	13.6	55	UHF
1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	.7	14	13.6	36	UHF
4450G	420-450	10	175	1.1	12	13.6	34	N
4452G	420-450	25	175	1.1	12	13.6	29	N

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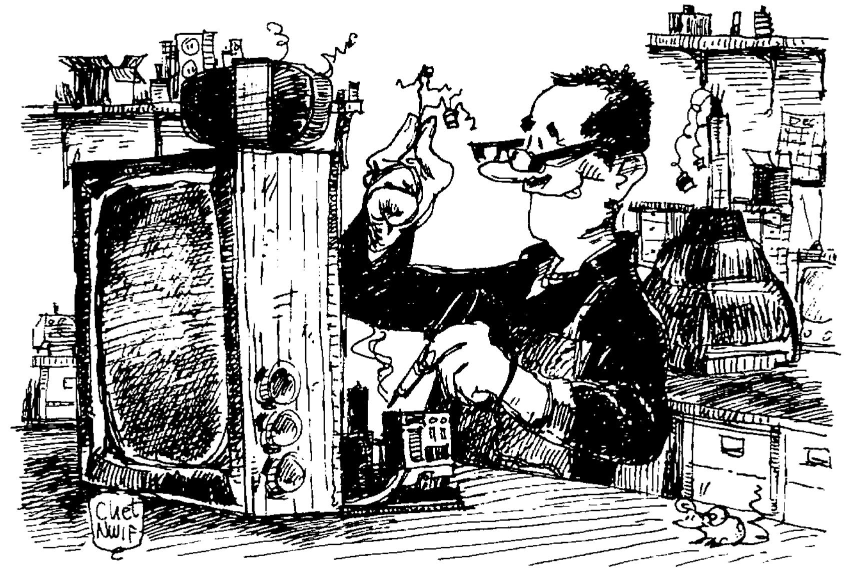
CIRCLE 232 ON READER SERVICE CARD

Scrounger's Guide to Recycled Electronics

Discover a goldmine of inexpensive parts.

by Jack Najork W5FG



Aside from Radio Shack, there are few commercial sources of electronic parts available to the builder or experimenter. Most catalog houses require minimum orders of $20 to $25, which is pretty discouraging to someone who needs just a few odds and ends for a weekend project.

However, if you are willing to do a bit of scrounging and desoldering, you can find an ample supply of parts just about anywhere. We live in a world conditioned to quickly discard anything electronic that is obsolete or doesn't work properly. The trash yards and dumps of America are filled with junked electronic products. The trick is to intercept them before they are carted off. A few words to friends and neighbors will insure that these jewels are held for your pickup. Aside from these "freebies," many items can be picked up at garage sales for a dollar or two. TV sets, radios, hi-fi combinations, CB radios, wireless telephones and car radios all contain parts that can be recycled for ham use. Let me give you some examples of components I've salvaged, modified (if necessary) and used for various projects. Then we'll get to the details of digging them out and identifying them.

From TV sets: ferrite cores and forms for RFI line filters and antenna baluns, slug-tuned RF coils, RF toroids, power supply rectifier diodes, filter caps, potentiometers, resistors, ceramic capacitors, switches, loudspeakers and many useless tubes. Some of the older or larger sets may include a power transformer.

From radios, wireless telephones and hi-fi combinations: ferrite rods, tuning capacitors, more slug-tuned coils and IF transformers, transistors, diodes, small loudspeakers, NiCd batteries and condenser microphones.

My home-brew transceiver sports an RF tuner (modified) that came from an old car radio. Double-balanced mixer and modulator transformers are wound on small ferrite slugs taken from low frequency IF transformers. The diodes came from a wireless telephone, as did most of the transistors used in the audio and IF stages. Some RF coils are wound on toroids made from slices of powdered-iron slugs—more on this later. The RF driver transistor in the transmitter section came from a CB radio, as did the "S" meter, loudspeaker and part of the metal housing. Truly, my junque box floweth over—and yours can also.

TV Sets

Warning: THE PICTURE TUBE OF ANY TV SET IS EXTREMELY HAZARDOUS, regardless of size. If mishandled, the tube can implode, flinging razor-like glass fragments with the force of a small bomb. UNDER NO CIRCUMSTANCES SHOULD YOU EVER STRIKE THE FACE OR BELL OF A PICTURE TUBE. Breaking a tube this way will produce a bomb-like implosion.

RF Coils, Toroids and Such

Unless your set is over 25 or 30 years old, the video IF section will contain 45 MHz slug-tuned coils and the audio section IF 4.5 MHz coils. (The audio coils are identifiable because they have many more turns.) The video coils can be stripped of their windings and used for RF circuits from 1.5 to 50 MHz. Most coils use ¼" diameter slugs which have a hollow hex core for insertion of a tuning tool. You can slice off small segments of these slugs, ⅛" or so thick, and use them as RF toroids. The easiest way to do this is to roll the slug back and forth under a single-edge razor blade or sharp knife. The powdered iron is quite soft and sections readily. Sand smooth the rough edges. Figure 1 shows the approximate inductance vs. turns for sections ⅛" thick. Thicker segments will yield slightly higher inductance, and vice versa. The Q factor of these coils is quite acceptable for most RF work, and I use them for oscillators and front-end receiver-tuned circuits.

Pocket radios, hi-fi sets, cordless telephones and CB radios contain many small, shielded RF and IF coils and transformers. Most sets use the standard 10.7 MHz and 455 kHz frequencies for FM and AM IF circuits, along with 25 MHz and 49 MHz for CB sets and cordless phones. A physical inspection will show the approximate resonant frequency of these devices, i.e. the 455 kHz transformers have many turns wound on small powdered iron bobbins while RF coils are wound on segmented plastic forms. Many of these devices will contain an inner powdered iron cup which fits over the coil form. The cups used for 10.7 MHz transformers and RF coils can also be used as toroid forms.

Figure 1 shows turns vs. inductance for RF cups 10/32" in diameter and 7/32" tall. The data in this figure should be taken as a general guide only. Manufacturers, variations in

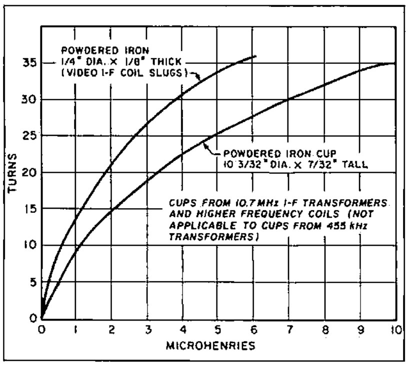


Figure 1. Approximate inductance vs. turns for toroids wound with #30 enameled wire.

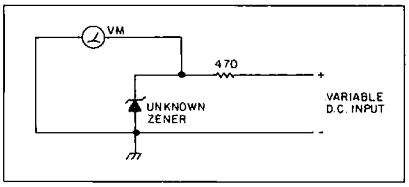


Figure 2. Test circuit for unknown zener diodes. Slowly increase DC voltage input from zero up. DC voltmeter (VM) reading will also increase and then stop at the zener diode's rated voltage.

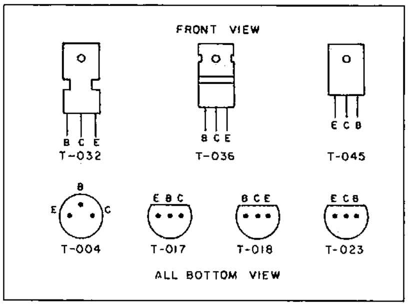


Figure 3. Transistor pin configurations.

material mix, spreading or compressing turns, and wire size can cause considerable variations in inductance. To be sure, use an L-C checker (See "Build This Simple L-C Checker," *Ham Radio*, December 1988 or "The Coil Tester," *73 Amateur Radio*, September 1990).

Cores and cups from 455 kHz transformers will yield very low Q, inefficient coils if used above 2 MHz or so. You can make a rough but effective check of core material with a grid-dip meter, provided the coils for the meter are made of tubing. Insert the slug or cup INTO the meter coil with the meter set to the frequency at which you plan to use the material. If the meter reading rises slightly, stays the same or drops slightly, the material can be used. If the meter reading drops sharply, the material is not suitable. If you are making coils to cover 160 to 10 meters, check the material at around 20 MHz. If it looks OK there it will work 160 to 10, although the circuit Q on the lower frequencies may not be quite as high as found with optimum material. RF designers use much more sophisticated methods, selecting the optimum core material for each frequency segment, conditioned on requirements for circuit Q, thermal stability, etc. (That's why the TS-940 is so expensive!)

Ferrite Slugs and Forms

Your TV set may also contain large, solenoid type coil forms tuned with ¼" diameter, hex-hole ferrite slugs for operation in the horizontal and/or vertical sweep circuits at 15.75 kHz and 60 Hz respectively. Ferrite slugs are more like glass and cannot be easily sliced. They can be used in the same manner as ferrite beads, to suppress RF on wiring. If you need short sections you can try filing or grinding to break off portions, and if you are lucky you will not end up with useless broken pieces as I generally do.

The horizontal/vertical deflection yoke positioned around the bell of the picture tube is wire-wound ferrite. Remove the wire and the ferrite may come apart or be held together with clips. When clipped together (or cemented with epoxy), the bell-like form becomes an effective, toroid type RFI filter form. Winding the AC power cord of your TV receiver or hi-fi set half a dozen turns around this core will prevent RF from getting in (or out) via this route. Ditto for the AC power cord of your transceiver or linear amplifier. For maximum effectiveness, wind on as many turns as the form will hold (or cord length will allow) and anchor them in place with twine or tape. The larger the picture tube, the larger the form, with 25" color sets yielding a form which is almost too large to hide behind a small set.

The horizontal high voltage transformer, generally housed in a separate metal enclosure will also yield useful ferrite material in "U" shaped sections bolted together, forming the transformer core. After the windings are removed the closed form can again be used for RFI suppression, as described for the yoke material.

"Another Balun Design" in *Ham Radio*, May 1982, describes the construction of an antenna balun made by winding six turns of small diameter coax on each opposing leg of the closed form. Another use for this material is the fabrication of a bifilar RF choke used for the filaments of cathode-driven linear amplifier tubes. (See "Hints and Kinks," *QST*, August 1989.)

Transistors and Diodes

Chances are, most of the equipment you salvage will come from the Far East. Although they use our color code on resistors and mark capacitors in English, transistors and diodes are a different story. Most plastic transistors will bear a letter/number identification that has no relationship to our 2N system. Here is the key to their system: Transistors prefixed with A or B are PNP, C and D are NPN, and FETs start with K. Some metal devices may use S followed by the A, B, C or

Continued on page 28

Table 1. Characteristics of the more popular transistors found in imported consumer electronic equipment.

Type	Description	HFE	Gain-BW Product MHz	Outline
A117	1W PNP-G	200	0.001	T-004
A128	1W PNP-G	90	1.5	T-004
A473	50W PNP-S	60	10	T-036
A495	0.6W PNP-S	100–320	120	T-017
A562	0.6W PNP-S	100–320	120	T-017
A634	10W PNP-S	120	150	T-039
A671	50W PNP-S	60	10	T-036
A673	0.4W PNP-S	150	200	T-017
C371	0.4W NPN-S	150	200	T-017
C394	0.6W NPN-S	100–320	120	T-017
C458	0.6W NPN-S	100–320	120	T-017
C460	0.4W NPN-S	150	200	T-017
C535	0.25W NPN-S	100	1100	T-017
C536	0.4W NPN-S	400	>90	T-017
C710	0.2W NPN-S	100	200	T-018
C723	0.25W NPN-S	100	1100	T-018
C733	0.4W NPN-S	400	>90	T-017
C763	0.25W NPN-S	100	1100	T-017
C828	0.75W NPN-S	250–500	350	T-023
C900	0.2W NPN-S	250–800	230	T-017
C929	0.65W NPN-S	50	500	T-023
C930	0.2W NPN-S	100	200	T-018
C945	0.6W NPN-S	100–320	120	T-017
C1060	50W NPN-S	60	10	T-036
C1096	10W NPN-S	> 85	65	T-032
C1173	50W NPN-S	60	10	T-036
C1213	0.4W NPN-S	150	200	T-017
C1237	20W NPN-S	100	>100	T-036
C1383	1W NPN-S	>120	200	T-023
C1674	0.65W NPN-S	50	500	T-023
C1815	0.6W NPN-S	100–320	120	T-017
C1909	20W NPN-S	100	100	T-036
C2038	5W NPN-S	200	250	T-045
D325	50W NPN-S	60	10	T-036

Continued from page 27

Parts List

C1	1 µF, 10V tantalum (or 10 µF electrolytic)
C2	1 µF, 25V tantalum (or 10 µF electrolytic)
R1	1000 ohm, 5%, ¼W
U1, U2, U4	74LS90 (or 7490)
U3	74LS74 (or 7474)
U5	7805 +5V regulator
XO1	Motorola K1160AA, 6 MHz

A blank PC board is available for $4.75 + $1.50 shipping per order from FAR Circuits, 18N640 Field Ct., Dundee IL 60118.

The 6 MHz crystal oscillator module, model XO-600, is available from Short Circuits, P.O. Box 285, Barnegat NJ 08005. (609) 698-3080.

ors, each about eight inches long, and connect one end of each wire to the proper point on the PC board; each output frequency is brought out on a separate wire. On the schematic, mark the wire colors you use, identifying each with the frequency it carries.

Testing, Testing

The pins on the oscillator XOI should be shortened by ⅛" with diagonal cutters so that the oscillator will seat snugly against its socket. Be certain the square corner on the oscillator package is at pin 1 on the socket. Do not install the other ICs yet.

Apply power, and measure the output voltage of the 7805. It should be between 4.96 and 5.5 for proper operation. Remove power and install the oscillator XO1. Apply power; then, using a frequency counter or receiver, check to see that outputs are available at 6 MHz intervals. Remove power.

Insert U1, 74LS90, in its socket and apply power. As above, check that it provides an output at 1 MHz intervals. Remove power. Insert U2 in its socket and apply power. Check to make sure it provides a 100 kHz signal at the proper intervals. Remove power. Insert U3, 74LS74, check for the 50 kHz and 25 kHz signals. Remove power. Insert U4, 74LS90 and look for the 10 kHz signals.

Caution: Always be sure power is off before inserting or removing ICs. Failure to do so may result in a destroyed IC.

Use a Blocking Capacitor

Apply power to the marker generator. Connect its output to your receiver's input. *Be sure you use a blocking capacitor (0.01 µF)!* Select the desired output frequency and locate it on your receiver. As you zero in on the desired portion of the spectrum, change the marker frequencies as you desire.

If you have followed the layout and schematic accurately, you now have an excellent crystal-controlled marker generator which covers a wide portion of the radio spectrum—and you've spent less than $10. . . even if you bought all the parts new! 73

Continued from p. 24

D and a series of numbers. Later model equipment may use Motorola transistors carrying 9000 series numbers which have no relationship to the ABCD system.

By far the easiest answer to unraveling the specifications for these devices is found in RCA's SK Series Replacement Guide. A second source is Radio Shack's Semiconductor Replacement Guide. Both of these list thousands of semiconductors with specifications and pinouts. If you are unable to get these books, see Table 1 for specifications of the more popular transistors.

You can sort out small diodes with an ohmmeter. In general, germanium types will have a lower forward resistance than silicon. Or, you can pass a small current through them (10 to 15 mA) and measure the DC voltage across the diode: 0.6 to 0.7 volts for silicon and 0.2 to 0.4 for germanium. Zener diodes are sometimes marked with 1N numbers or they may have just a single digit, such as 8, on the body, signifying an 8 volt zener. Otherwise, these can be identified by using the circuit shown in Figure 2.

RF Tuners From Car Radios

Many radios (Collins, Yaesu FT-101, etc.) use RF tuners (also called preselectors) which consist of two or more coils slug-tuned via a front panel control. This type of tuner simplifies multiband frequency coverage because it can cover a larger frequency spread more efficiently and with fewer components than a design using variable capacitors. The same form of inductive tuning is used in most automobile radios. If you are adept and patient, you can convert these to ham band use. The slugs used for the BC band cannot be used for the higher ham bands (3.5 MHz up). If your radio is AM and FM you can take the slugs from the FM section of the tuner (which won't be used) and use them in place of the AM slugs. The "Q" factor on the lower frequency bands won't be quite optimum with these slugs but they will still be very satisfactory.

The BC band coils must be stripped and rewound with 15 to 25 spaced turns to achieve an inductive range of around 1µH to 4µH tuning spread. The tricky (and difficult) part is to wind both coils identically so that the inductances track closely with slug penetration. My version varies from 1.4µH to 4µH and covers 3.5 to 29 MHz in conjunction with band-switched capacitors.

Other Components

Aside from consumer electronic products, many valuable components can be found on scrapped circuit boards sold at hamfest flea markets. I have found boards loaded with VHF power transistors, hot-carrier diodes, miniature relays, etc., for as little as 25¢ each. The law of supply and demand is tilted way over to the supply side because there are not too many of us builders and experimenters around. Join the ranks of the privileged few. 73

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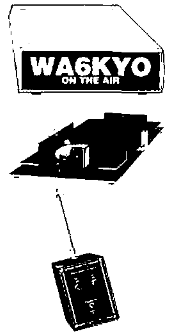

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An HF/VHF/UHF Marker Generator

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by J. Frank Brumbaugh KB4ZGC

Many hams operate HF as well as the 2m, 1¼m, and 70cm bands, and higher. Most marker generators hams build provide outputs only at 100, 50, and 25 kHz. This is adequate for the HF bands, but it's impossible to identify even a specific 100 kHz marker at VHF and higher. You need harmonic-rich outputs in the megahertz range to facilitate identification at these higher frequencies.

Motorola's K1160AA

The marker generator described here provides square wave outputs at 6 and 1 MHz, and at 100, 50, 25 and 10 kHz. I chose 6 MHz because its harmonics accurately mark 144 MHz, 222 MHz, 420 MHz, many points in the 70cm band, plus 450 MHz. The remaining outputs enable identification of as close as 10 kHz points in between.

The heart of this circuit is a 6.000 MHz crystal oscillator made by Motorola: the K1160AA. Self-contained in a sealed metal can, it fits a 14-pin DIP socket. It operates from a +5 VDC regulated supply and draws 65 mA. Output is a square wave rich in harmonics. It is available from Short Circuits, PO Box 285, Barnegat NJ 08005 for $1.00. The Part Number is XO-600.

See the circuit in Figure 1 and the parts placement in Figure 3. The oscillator and all other parts were obtained from Short Circuits. The filter capacitors and the resistor came from the junk box.

How the Marker Generator Works

A +5 VDC fixed regulator 7805 provides a nominal +5 VDC to the circuit, which requires 100 to 150 mA, depending on the ICs selected. The 74LS chips require much less current. Use a scrap of aluminum to make a small home-brew heat sink.

The oscillator, XO1, feeds a square wave at 6 MHz to U1, 74LS90, which is connected to divide by six. Output is a 1 MHz square wave which is fed to U2, 74LS90, connected to divide by ten. The resulting 100 kHz square wave is fed to U3, 74LS74, which is connected to divide by both two and four, producing square wave outputs at 50 and 25 kHz. The 50 kHz output from U3 feeds U4, 74LS90, connected to divide by five, thus producing a square wave output at 10 kHz.

All outputs are brought out on separate wires. They can be connected through a 1-pole, 6-position wafer switch for convenient selection to an output connector. They may also be brought out to separate connectors. Because a DC voltage also appears on these output lines, you must use a small blocking capacitor when you use the generator with a receiver.

Construction

Install the IC sockets on the PC board and solder in place. The oval shaped pin on the PC board indicates pin 1 for each IC.

Bend the pins on U5, the regulator 7805, so it will lie flat against the PC board mount, and solder it in place. Through the small hole in the tab of the 7805, drill a hole through the PC board, if desired for later attachment of the home-brew heat sink. You can add the filter capacitors now or later.

Take six insulated wires of different col-

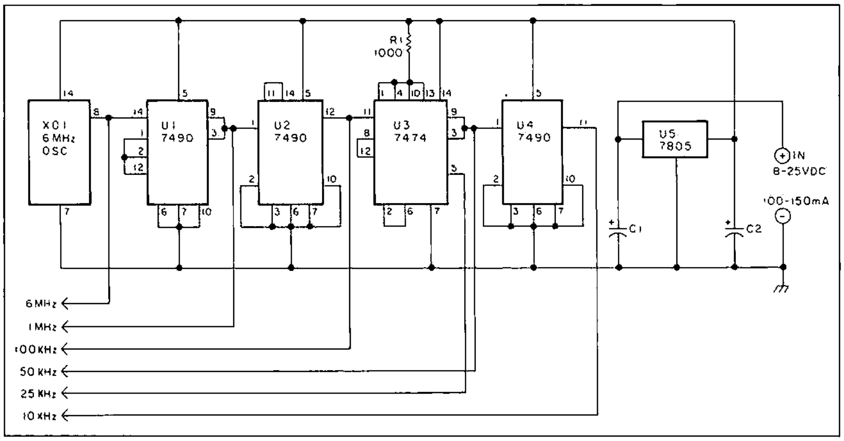


Figure 1. HF/VHF/UHF marker generator schematic.

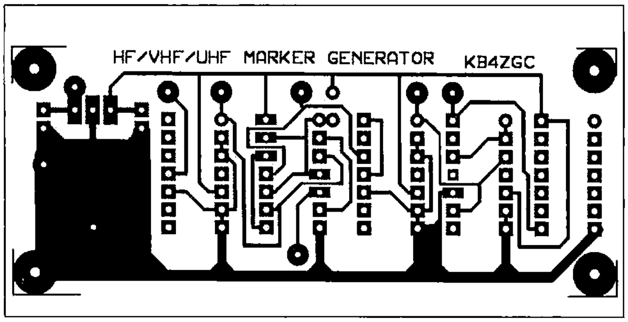


Figure 2. PC board foil pattern.

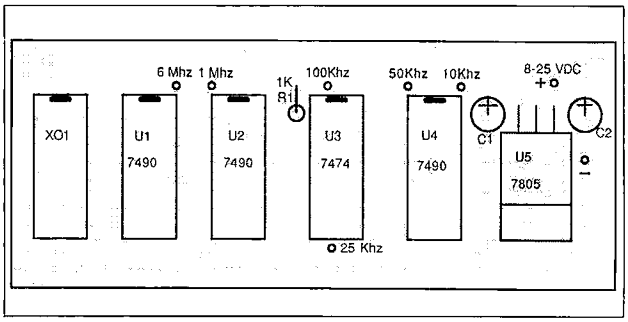


Figure 3. Parts placement.

A Parallel Port I/O Board

Control your world!

by Wally Gardiner VE6BGL

If you've recently purchased one of the new IBM PC clone computers for the ham shack, you have probably been wanting to use it to control the coffee pot, the antenna rotator, and who knows what else! This article describes how to use the parallel port, which normally connects to the printer, as an input/output port to control the outside world (see Figure 1).

The parallel port on most clone computers exits the back of your machine in a 25-pin female connector. Table 1 shows the necessary pinouts of the printer port as you face the computer. For our purposes, we can ignore all the other pins on the connector.

The computer sends data to the printer using pins 2 through 9, and with simple programs written in BASIC, we can send data to our interface board the same way. The IBM series of computers are port-oriented, and a port can be addressed easily using the OUT command. This is similar to using the POKE command to store a value in memory. Instead of appearing in memory, the value will appear on the data lines of the specified port. Using LPT2, as an example, the command OUT 632,0 would latch all of the data lines low, while a command OUT 632,5 would set data lines 2 and 0 high. Why, you ask? Binary arithmetic! Examine Table 2.

By OUTputting the appropriate decimal number, we can control which lines on the parallel port will be HIGH (+5 volts) and which will be LOW (0 volts). This even lets us control more that one thing at a time, handy for azimuth and elevation rotators for an OSCAR pass, for example. It can walk AND chew gum!

Customizing the Interface

The remaining problem is to interface the data lines coming from the computer to the real world without causing any mushroom clouds inside the machine. Obviously, we don't want 120 volts zinging around our motherboard! Take a look at the schematic in Figure 2. All this does is buffer the data line pulse by feeding it through a diode and a 1k resistor to the base of an NPN transistor, causing the transistor to act as a switch. Data bits 0 through 3 are connected to larger power transistors and monitor LEDs, and can be used to control high current items such as stepper motors, while data bit 4 is connected to a relay driver.

If the I/O board were connected to LPT2 on an XT, typing a command from BASIC, such as OUT 632,16, would cause the relay to close, while an OUT 632,0 would make it open. The relay in turn could be connected to lights, the coffee pot (through a larger relay to handle the higher current!), your rotator, or the key for your rig! So how about a practical application? Depending on the kind of keying your rig requires, the I/O will key it either through a relay, an optoisolator, or from the transistor. Consult your manual, and if you're not sure, use the relay method.

```
10 CLS
20 PRINT "Program to test LPT2 port"
30 PRINT "************************"
40 PRINT:PRINT
50 OUT 632,0
55 GOSUB 1000
61 OUT 632,1:SOUND 40,1
65 GOSUB 1000
70 OUT 632,2:SOUND 80,1:GOSUB 1000
72 OUT 632,4:SOUND 160,1
75 GOSUB 1000
83 OUT 632,8:SOUND 320,1
85 GOSUB 1000
90 GOTO 50
999 END
1000 FOR TDLY=1 to 2:NEXT TDLY:RETURN
```

Listing 1. Stepper program.

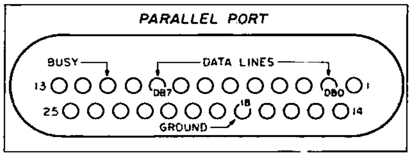


Figure 1. You can use this parallel port, which normally connects to your printer, to control more than one device at a time.

To test your interface, run the program STEPPER.BAS, Listing 1. The port addresses may have to be changed, depending on your particular machine. When STEPPER.BAS is run, all the LEDs on your I/O board should make like an old-fashioned police scanner, blinking sequentially. If the lights don't blink, troubleshoot!

Note that the port number 632 may also have to be changed depending on your computer. Other numbers to try are 888 and 956. Check the documentation that came with your machine. HINT: If your manual says something like HEX 3BC, and you want to convert that to decimal from BASIC, type: ? &H3BC and BASIC will return a value of 956 decimal.

Output Control

Now that your interface has been tested, it's time to do something with it. Enter and SAVE the program MORSE.BAS, Listing 2. This program will allow you to type on the keyboard and send Morse code either through the speaker for code practice study groups, or out the parallel port (Data Bit 0) to control the LED. The LED will blink on and off in Morse, and would make a great signaling device.

If your rig can be keyed by a transistor, the LED can be paralled with an optocoupler, and used to key

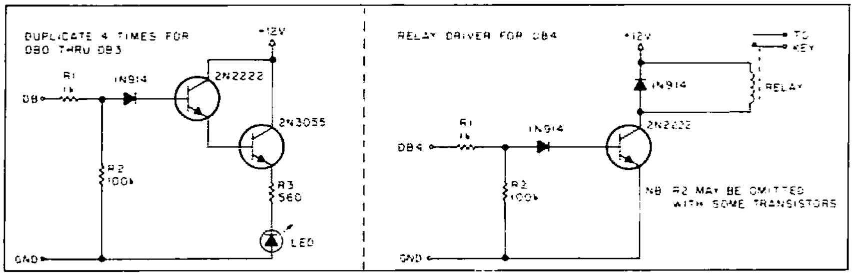


Figure 2. (a) Data bits 0 through 3 are connected to larger power transistors and monitor LEDs. (b) The relay driver for DB4.

```
5 KEY OFF
10CLS
20 REM do title screen
25 FOR LN=1 to 9:PRINT:NEXT LN
30 PRINT "========================================="
40 PRINT "=      Morse Code Keyboard Program      ="
50 PRINT "=                   by                  ="
60 PRINT "=         W.S. Gardiner VE6BGL          ="
70 PRINT "=      Box 2035 High River Alberta      ="
80 PRINT "========================================="
90 GOSUB 10000:CLS
100 REM get hardware information
105 CLS
110 PRINT "                 Hardware Menu"
120 PRINT "                 *************"
125 FOR LN=1 TO 5:PRINT:NEXT LN
130 PRINT "      Parallel Port      HEX      DECIMAL"
135 PRINT "      *************      ***      *******":PRINT
140 PRINT "         1) LPT1:        3BCH      956"
150 PRINT "         2) LPT1:        378H      888"
160 PRINT "         3) LPT2:        278H      632"
165 FOR LN=1 TO 5:PRINT:NEXT LN
170 PRINT "Check your system documentation and select 1, 2 or 3
from the menu"
180 INPUT ANS
181 IF ANS=1 THEN PORT = 956
192 IF ANS=2 THEN PORT = 888
183 IF ANS=3 THEN PORT = 632
184 IF ANS>3 THEN GOTO 190
185 GOTO 200
190 PRINT "Please type a number between 1 and 3"
195 GOSUB 10000:GOTO 100
200 REM start of program loop
205 OUT PORT,0
210 CLS
220 PRINT "Would you like sound from the computer? (y/n)"
225 ANS$=INKEY$:IF ANS$="" THEN 225
230 IF ANS$="y" THEN FLAG=1
231 if ANS$="Y" THEN FLAG=1
240 IF ANS$="n" THEN FLAG=0
241 IF ANS$="N" THEN FLAG=0
245 PRINT:PRINT:PRINT
250 PRINT "Instructions: "
255 PRINT "*************":PRINT
260 PRINT " Type a letter on the keyboard and it will be sent to"
270 PRINT "the screen and the parallel port that you selected."
280 PRINT "Hit any key to start the program...."
290 A$=INKEY$:IF A$="" THEN 290
295 CLS
300 REM program loop starts here
310 A$=INKEY$:IF A$="" THEN 310
315 IF A$="1" THEN GOTO 14000
316 IF A$="0" THEN GOTO 15000
317 IF A$=" " THEN GOTO 16000
330 READ J$
335 IF J$="*" THEN RESTORE
340 IF J$=A$ THEN GOTO 400
350 IF J$="*" THEN GOTO 310
360 GOTO 330
400 REM output the data
410 PRINT J$;
420 IF FLAG=1 THEN GOTO 500
430 IF FLAG=0 THEN GOTO 1500
499 GOTO 300
500 FOR N=1 TO 10
510 READ K
520 IF K=0 THEN GOSUB 11000
530 IF K=1 THEN GOSUB 12000
535 IF K=99 THEN RESTORE
540 IF K=99 THEN GOTO 300
550 NEXT N
570 GOTO 300
1500 FOR N=1 TO 10
1510 READ K
1520 IF K=0 THEN GOSUB 18000
1530 IF K=1 THEN GOSUB 19000
1535 IF K=99 THEN RESTORE
1540 IF K=99 THEN GOTO 300
1550 NEXT N
1570 GOTO 300
9000 DATA a,0,1,99
9001 DATA b,1,0,0,0,99
9002 DATA c,1,0,1,0,99
9003 DATA d,1,0,0,99
9004 DATA e,0,99
9005 DATA f,0,0,1,0,99
9006 DATA g,1,1,0,99
9007 DATA h,0,0,0,0,0,99
9008 DATA i,0,0,99
9009 DATA j,0,1,1,1,99
9010 DATA k,1,0,1,99
9011 DATA l,0,1,0,0,99
9012 DATA m,1,1,99
9013 DATA n,1,0,99
9014 DATA o,1,1,1,99
9015 DATA p,0,1,1,0,99
9016 DATA q,1,1,0,1,99
9017 DATA r,0,1,0,99
9017 DATA s,0,0,0,99
9019 DATA t,1,99
9020 DATA u,0,0,1,99
9021 DATA v,0,0,0,1,99
9022 DATA w,0,1,1,99
9023 DATA x,1,0,0,1,99
9024 DATA y,1,0,1,1,99
9025 DATA z,1,1,0,0,99
9027 DATA 2,0,0,1,1,1,99
9028 DATA 3,0,0,0,1,1,99
9029 DATA 4,0,0,0,0,1,99
9030 DATA 5,0,0,0,0,0,99
9031 DATA 6,1,0,0,0,0,99
9032 DATA 7,1,1,0,0,0,99
9033 DATA 8,1,1,1,0,0,99
9034 DATA 9,1,1,1,1,0,99
9036 DATA .,0,1,0,1,0,1,99
9037 DATA /,1,0,0,1,0,99
9038 DATA ?,0,0,1,1,0,0,99
9040 DATA ',0,0,0,1,0,1,99
9041 DATA =,0,1,0,1,0,99
9998 DATA *,*,*,*,*,*,*
9999 END
10000 REM time delay subroutine for program titles
10010 FOR TDLY=1 TO 5000:NEXT TDLY:RETURN
11000 REM sound routine for a dot
11010 SOUND 200,1
11015 GOSUB 13000
11020 RETURN
12000 REM sound routine for a dash
12010 SOUND 200,3
12015 GOSUB 13000
12020 RETURN
13000 REM pause subroutine between letters 1 dit spacing
13010 SOUND 9000,1:RETURN
14000 REM special subroutine to sound a number 1
14005 IF FLAG=0 THEN GOTO 24000
14010 GOSUB 11000:FOR H=1 TO 4:GOSUB 12000:GOSUB 13000:NEXT
H
14015 RESTORE
14020 GOTO 300
15000 REM special subroutine to sound a number 0
15005 IF FLAG=0 THEN GOTO 25000
15010 FOR H=1 TO 4:GOSUB 11000:GOSUB 13000:NEXT H:GOSUB
11000
15015 RESTORE
15020 GOTO 300
16000 REM special subroutine to print a space
16010 PRINT "  ";
16020 RESTORE
16030 GOTO 300
18000 REM output a dit to the parallel port (bit zero)
18010 OUT PORT,1
18020 FOR TDLY=1 TO 300:NEXT TDLY
18030 OUT PORT,0
18040 RETURN
19000 REM output a dash to the parallel port (bit zero)
19010 OUT PORT,1
19020 FOR TDLY=1 TO 900:NEXT TDLY
19030 OUT PORT,0
19040 RETURN
24000 REM subroutine to send a number 1
24010 GOSUB 18000:FOR H=1 TO 4:GOSUB 19000:NEXT H
24015 RESTORE
24020 PRINT A$;
24025 GOTO 300
25000 REM subroutine to send a number 0
25010 FOR H=1 TO 5:GOSUB 19000:NEXT H
25015 RESTORE
25020 PRINT A$;
25025 GOTO 300
```

Listing 2. Morse code keyboard program.

the rig directly. If you are not sure about this, modify the program to control the relay, and use the relay contacts to send Morse. This is mandatory for older tube rigs, and anything else that normally has high voltage across the key contacts. It involves changing lines 18010 and 19010 to ?????. Darn, a quiz in the middle of the article! We want data bit 4, and only data bit 4, to be HIGH, so we would use the command OUT 632,16, where 632 is the LPT2 address and 16 is the decimal value we want to appear on the port. Therefore, lines 18010 and 19010 should both be changed to read OUT PORT,16. [Ed. Note: PORT is the variable

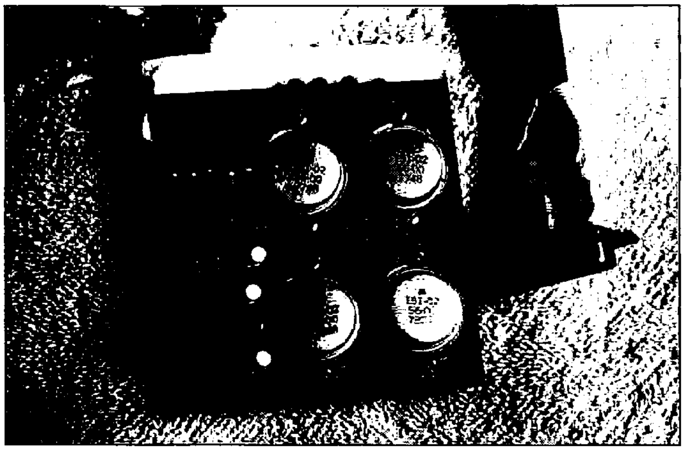
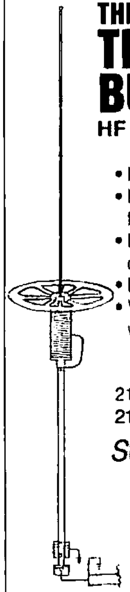


Photo. Once you've constructed your parallel interface, you're ready to experiment with it.

```
10 REM Program to test BUSY line
20 CLS
30 A=INP(633)
40 PRINT A
50 PRINT " BUSY LINE NOW READS ";A
60 PRINT:PRINT "CONNECT BUSY LINE TO
   GROUND ON PIN 18, HIT ANY KEY"
65 A$=INKEY$:IF A$="" THEN 65
70 B=INP(633)
80 PRINT "BUSY LINE NOW READS ";B
90 END
```

Listing 3. Input test program.

Are You Serious
About HF mobile operation?



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that indicates the particular port address of your machine.]

MORSE.BAS is written in simple, non-sneaky, generic BASIC, and you should be able to port it to almost anything. I have run the code practice part of the program on everything from a Color Computer to an antique Commodore PET! To adapt it to a different computer involves changing the SOUND and OUT routines to something that your computer can use. For CoCo owners, the program adapts nicely to controlling the serial port, and I would imagine something similar can be done for the Apple and C-64.

Input Detection

So much for getting stuff out of the computer. How do we get data into it? Well, it turns out that BASIC also has a command called INP for INPUT and you can use a line used such as:

1000 A = INP(X)

where X is the port address PLUS one. So X might be 889, 633, or 957, depending again on your particular system. This command will read the status of the BUSY line on the printer port, and return a value of (usually) A=255 if it's LOW, or 128 if it's HIGH. Connect a push button switch between pin 18 (ground) and pin 11 (BUSY) and run the program BUSYTEST.BAS, Listing 3. With the appropriate receive software, you are now all set to automate the CW end of the station.

Practically, however, it has been my experience that the computer between your ears is much better at decoding the 20 meter band than any machine. But you could use the BUSY line with a microswitch to sense when a rotator had reached a point, a gate had been shut, or a window was left open!

For those of you with Rube Goldberg tendencies, use the relay to turn on the coffee pot (OUT 632,16), and a thermistor connected through the BUSY line to detect when it's ready. Automatic microprocessor controlled coffee!

I'm sure you will find your own uses for the board. For those of you who despise typing as much as I do, 5¼" disks are available for $10 U.S. and an SASE. *[Ed. Note: Listings of the three BASIC programs are also available free on the 73 BBS under the 73mag SIG. The BBS number is (603) 525–4438.]* Enjoy!

Table 1. Printer Port Pinouts

Pin #	Function
1	Strobe
2	Data Bit 0
3	Data Bit 1
4	Data Bit 2
5	Data Bit 3
6	Data Bit 4
7	Data Bit 5
8	Data Bit 6
9	Data Bit 7
10	Acknowledge
11	Busy
12	Out of Paper
13	Printer on line
18	Ground

Table 2. Binary Arithmetic

Decimal Number	Data Bits
	76543210
0	00000000
1	00000001
2	00000010
3	00000011
4	00000100
5	00000101
6	00000110
7	00000111
8	00001000
9	00001001
10	00001010
11	00001011
12	00001100
13	00001101
14	00001110
15	00001111
16	00010000

Table 3. The Experimental I/O Interface

Qty.	Part	Description
5	2N2222	NPN transistor
4	2N3055	NPN transistor
4	LEDs	Light Emitting Diodes
6	1N914	diodes
5	1k (R1)	resistor, ¼ watt
5	100k (R2)	resistor, ¼ watt
4	560 (R3)	resistor, ¼ watt
1	LM4	12 volt relay
1	DB25	male connector, 25 pin

Misc. assorted hardware, ribbon cable, pert board, etc.

Notes: Resistor R2 (100k) may not be necessary, depending on the transistor selected. Check the polarity of the LEDs when installing them. Relay contacts must be able to handle the current of the switched device. Don't use a miniature relay to control an arc welder! The relay coil MUST be paralleled by a diode.

You may contact Wally Gardiner VE6BGL at Box 2035, High River, Alberta Canada T0L 1B0.

73 Review

by Jeffrey A. Meyer N8AHA and Bill Brown WB8ELK

The WB2OPA LogMaster

A versatile HF logging program for the IBM PC.

Sensible Solutions
P.O. Box 474
Middletown NJ 07748
Price class: $60

The contest is over and you're the lucky op who lost the toss, and gets to organize the logs and send them in to the contest sponsor for credit. UGHHH! Making sense of the log sheets and reading the slop your group calls handwriting can certainly try anyone's patience, especially after hours of screaming phonetics and pounding brass. There must be a better way! Enter the idea of having a personal computer present during the contest to perform your logging, check dupes, and print the results in completed form at the conclusion of the contest.

To help me cope, I began looking for software programs that have the capabilities to make contesting and logging easier. My desires were simple. First and foremost, the software must be easy to understand and have a manual that doesn't resemble "War and Peace." Second, it must be flexible enough to work for different contests as well as provide duping, logging and printing functions. Finally, it must be compatible with my current computer system so that I can spend more money on ham type stuff.

The Sensible Solution

I recently ran across the WB2OPA LogMaster program by Sensible Solutions. This particular program was written specifically for HF logging and contesting, and it works on my IBM PS/2 (or any IBM PC/compatible). I read the manual and really enjoyed tinkering with the program. The inner workings revolve around easy-to-use pop-up windows which guide the user through the various segments of the program: Log, View, Search, Print, Utilities, and Quit. Each segment is well thought-out and extremely easy to learn and use. Aside from the expected Time-Call-Freq-RST-Mode logging functions, the LogMaster Includes fields for tracking and reporting CQ zones, ITU zones, states, prefixes, beam headings, starting and ending QSO times, counties and QSL functions. The contents of these various fields as well as the final log can also be viewed, modified and finally printed for contest submissions.

Getting Started

LogMaster runs on an IBM PC or compatible and needs at least 512k of RAM. You need either two floppy disk drives or one floppy drive and one hard drive. Installation is quick and easy. To run the program just enter the command "LM" at the DOS prompt.

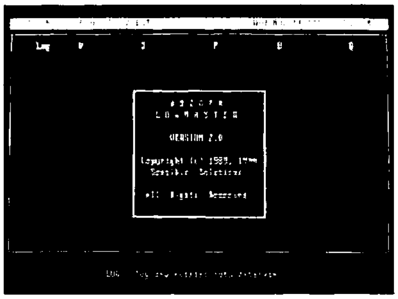


Photo A. The LogMaster main menu.

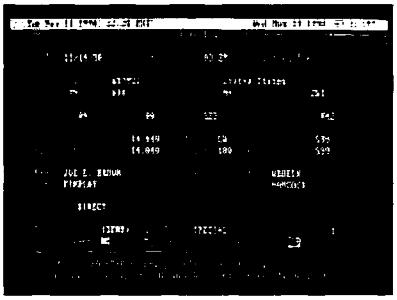


Photo B. Entering your QSO information.

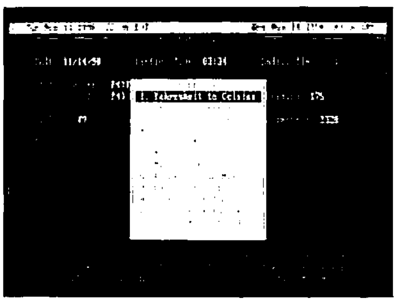


Photo C. Metric conversion pop-up window.

The first time you install LogMaster, you enter the local time zone, latitude and longitude, input power, and the directory path for your logbook file. Thereafter, you go directly to the main menu on start-up.

The main menu comes up with several categories: Log, View, Search, Print, Utilities, and Quit (see Photo A).

Access to each submenu is driven by single keystroke commands. Each command drives a series of pop-up menus which guide you easily through all the features. Hitting the ESC key brings you back to each previous menu.

Logging In

The Log section allows you to enter stations worked into your logbook database. You have two options of entry. The "Manual" selection allows you to enter calls with complete control of the time and date—useful for entering contacts made from contest logsheets, for example. The "Auto" mode automatically enters the date and time for each contact in real-time. The Log entry screen provides a lot of information about each contact, including QSL sent/received status (see Photo B). During the logging process a series of function key commands are available which really enhance an already powerful program.

One of the most useful of these is the "Notepad" function. You can literally write a full page of information describing a contact. When viewing a specific entry in the logbook, you can recall this notepad with just a function key. Other function key commands allow you to update the frequency (if using a computer interfaced radio), enable the QBICSP option (which highlights a contact if you need it for a specific reason), enable an RST-sent serial number for each contact in a contest, do dupe checking while logging, check QSO start and stop time, tag a QSO or do quick a save function (you don't have to step through ail of the log entry items). If you have a Kenwood rig with a computer interface, LogMaster will automatically enter your current transmit and receive frequency when in "Auto" mode. Other rigs should be similarly supported in future revisions.

The "Dupe" checking feature is a very flexible function. You can check dupes for callsign, country, state, CQ zone, ITU zone, or prefix. It highlights the call and beeps whenever a dupe situation is encountered. The Tag function allows you to add a specific bit of information to your logged QSO, which you can search for later. For example, if you want to mark all your QRP, RTTY, or AMTOR contacts, you can put a specific tag on them and just list out only your QRP contacts.

Another nice pop-up window is available during the logging process which is particularly useful for foreign contacts. By hitting <Alt-C> you get a metric conversion program (see Photo C)!

Viewing

The "View" menu allows you to sort out your logbook and display it in different ways.

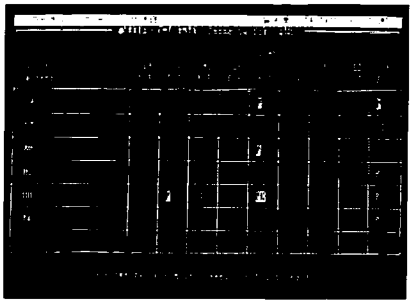


Photo D. Multiband logbook summary.

Utilities

This section allows you to customize the program to your individual specifications. Dupe checking searches can be reconfigured here and you can also select a new file path for different logbook entries (a useful feature for a specific contest entry).

I found the Statistics section particularly interesting. Selecting this submenu allowed me to look at my countries, states, CQ zones, or ITU zones worked. This display quickly gave me a multiband display of my progress in each of these categories (see Photo D). In addition, you can display QSL activity and total QSOs in this manner.

W B 8 E L K   L O G B O O K

DATE	TIME	STATION	FREQ	MOD	RST	RST	NAME	S	R	N	T
11/06/90	23:39	WB2MGP	28.303	USB	59	59	CAROLE	N	N	N	N
11/06/90	23:40	WB6NOA	28.333	USB	59	59	GORDON	N	Y	N	N
11/06/90	23:40	W2NSD/1	14.313	USB	59+	59+	WAYNE	S	Y	N	N
11/06/90	23:41	KA8LWR	14.233	USB	59	59	MEL	N	Y	N	N
11/06/90	23:42	W9AZO	14.230	USB	58	58	JIM	Y	Y	N	N
11/06/90	23:43	K8PYQ	14.230	USB	57	57	LOWELL	N	N	N	N
11/06/90	23:44	WB8MSJ	14.040	CW	599	599	JOE	S	Y	N	N
11/06/90	23:44	KA8WLV	07.040	CW	599	599	JEFF	N	N	N	N
11/06/90	23:45	WB8VNC	28.400	USB		57	DICK	N	N	N	N
11/06/90	23:45	WB9KMO	14.233	USB	56	57	ROD	S	Y	N	N
11/10/90	01:19	N1GPH	28.060	CW			DAVID	N	N	N	N
11/10/90	01:20	WB8MSJ	14.040	CW	599	579	JOE	S	Y	N	N
11/10/90	01:21	KA8LWR	14.233	USB	59	57	MEL	Y	Y	N	N
11/10/90	01:21	WB9KMO	14.233	USB	59	59	ROD	N	N	N	N
11/10/90	01:27	P43T	28.400	USB	59+	59+	TONY	N	Y	N	N
11/10/90	01:28	KA8LWR	03.871	LSB	58	59	MEL	S	Y	N	N
11/10/90	01:33	KA8LWR	28.680	USB	57	58	MEL	N	N	Y	N
11/10/90	01:36	K7IRK	28.636	USB	59+	59+	BOB	N	N	Y	Y

Figure. Logbook printout.

You can display the entries sorted by date, country, state, callsign, CQ zone, ITU zone, prefix, tag or QSL sent/received marks.

A note about the record-protection feature: "Protect All Fields" prevents you from changing any entry; "QSL Edit Only" allows QSL status information editing; and Edit All Fields allows complete editing. This feature adds another keystroke when you're looking for log entries, but it helps prevent you from making inadvertant errors!

I found the sorting feature of the LogMaster incredibly useful. I could literally display all of the contacts I made with just one station. If I wanted to list out only my QRP contacts, I used the Tag function.

Searching

Although similar to the "View" menu, the Search area allows you to search for partial search keys. For example, if I wanted to find my QSO with KA8WLV but forgot his suffix, I would search for all calls beginning with KA8 until I found him.

Printing

This menu is handy if you'd like a hardcopy printout of your logbook (see the Figure). You can print out your whole logbook or start from a particular date. Of particular interest to contesters is the "Awards Dupe Sheet". This option prints out your log sorted in callsign order.

Useful Utilities

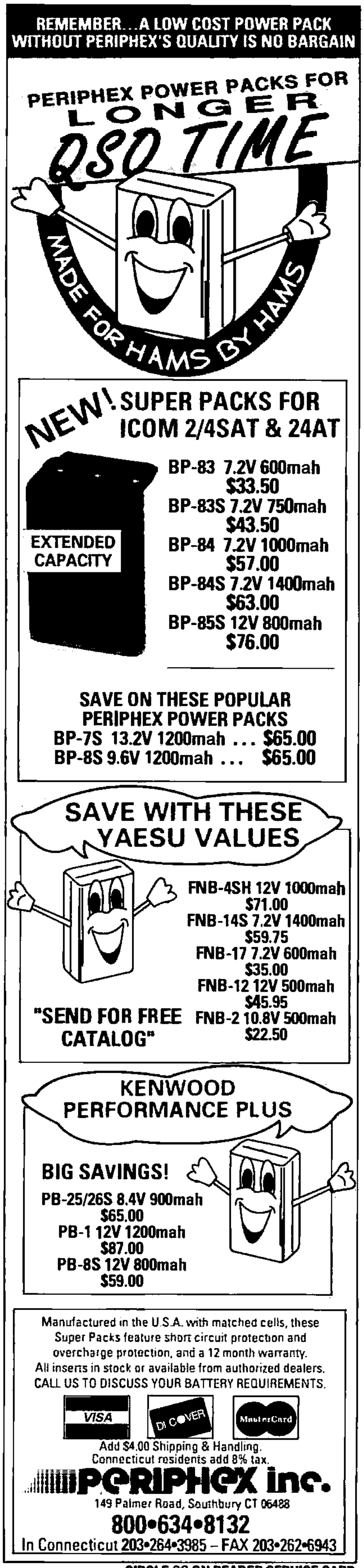
In addition to LogMaster, you will find two utilities on the diskette. Merge allows you to merge two logbook databases into one logbook.

And you can print your own QSLs! QSL labels and even QSL cards can be printed with this handy utility. It uses your logbook database to print out specific cards right on your printer.

Impressions

I found the WB2OPA LogMaster very easy to use. The versatility of sorting your logbook by different search patterns and the notebook area made it extremely useful. I found that if anything, there were too many categories for each logbook entry. Fortunately, there is a quick save function key. You should also be careful to enter the FULL path for each new logbook, or you could inadvertantly erase a previous log.

I was pleasantly surprised with all of the functions and the ease of operation of the HF LogMaster. I only wish it could be used for VHF/UHF contacts as well. The LogMaster really shines when you consider the time saved in entering and maintaining a logbook, particularly the log sheet paper jam that builds up during a contest. ■



CIRCLE 68 ON READER SERVICE CARD

73 Review

by Ron Hranac N0IVN

Kenwood's TM-941A Triband FM Transceiver

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Phone: (213) 639-4200
Price Class: $1200

First there were single-band FM transceivers, then came dual-band rigs. Now there's a three-band radio, Kenwood's new TM-941A triple-band FM transceiver that covers 2 meters, 70 centimeters and 23 centimeters. With this one rig you can operate on the 144, 440 or 1200 MHz amateur bands.

Kenwood has managed to squeeze three transceivers into one small package measuring 5.91"W x 1.97"H x 6.89"D. It feels like three transceivers, though, weighing in at over four pounds.

What the TM-941A Offers

The TM-941A is designed for 13.8 VDC operation at a maximum of 11.5 amps (high power transmit on 2m). It comes with several standard accessories, including a mobile mounting bracket, DTMF microphone, DC power cable, an extra fuse, a 56-page instruction manual, warranty card, and an assortment of miscellaneous hardware. Also included is a nice feature that's recently become popular on a number of other mobile rigs: a detachable front panel. With either the optional PG-4K or PG-4L interconnect kit, the transceiver body can be located remotely from the front panel. This is especially handy in some of today's cramped smaller autos, and provides an added measure of security in any vehicular installation.

Three RF output power levels are available on 2m and 70cm: HI output on 144 MHz is 50 watts, MID is 10 watts and LOW is around 5 watts. The power levels on 440 MHz are 35, 10 and 5 watts respectively. Two power output choices are available on 1200 MHz, 10 watts (HI) and 1 watt (LOW).

As shipped from the factory, the TM-941A transmit frequency ranges are 144–148 MHz, 438–450 MHz and 1240–1300 MHz, and modifications for MARS/CAP are possible. Receive coverage on 2m is 118–174 MHz (including AM reception in the aeronautical bands, although the instruction manual makes no mention of this). The 70cm and 23cm receive frequencies are the same as the transmit frequencies, but a modification is available that will expand the reception coverage to 400–475 and 1210–1330 MHz.

The three transceivers are about as separate as is possible in one radio. Kenwood has provided each band with its own volume and squelch control, antenna connection, display area on the front panel LCD, and external speaker jack. The radio's single internal speaker is common to all three bands, and there is a fourth speaker jack available that can route the three bands' combined audio to a single external speaker. You could conceivably have as many as four external speakers connected–one for each of the three separate bands, and one for the combined audio.

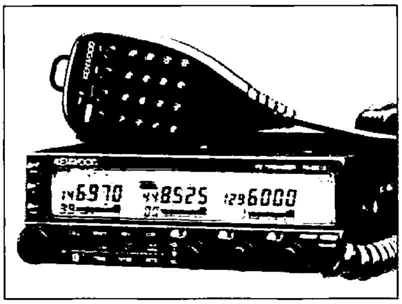

Photo A. The Kenwood TM-941A tribander.

This separate functionality means that you can simultaneously receive on all three bands, and even configure the rig for cross-band repeat operation (I wasn't able to test this feature and there's no mention of how to do it in the instruction manual).

The Features

The TM-941A is packed with all the features and capabilities typical in modern microprocessor-controlled transceivers. Space restrictions preclude a review of all of them (the instruction manual is 56 pages long, not including the schematic and block diagrams), so I'll highlight a few of the major ones that are either standard or are available as options.

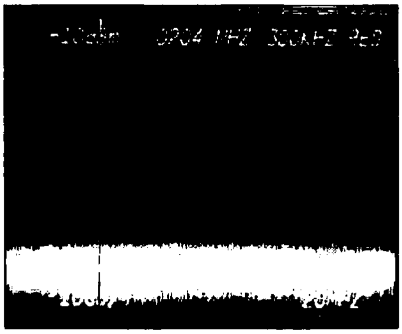

Photo B. Spectrum output from the TM-941A, representative of all three bands' performance. (The photo is of a 2 meter TX signal on a Tektronix 7L14 analyzer.)

CTCSS encoder: There are 38 subaudible tones included, selectable from the front panel. The rig I tested did not have the optional TSU-7 CTCSS decoder, but the module is easily installed in a socket accessible behind the front panel.

Dual-tone squelch system: If the optional DTU-2 module is installed, this function allows what Kenwood describes as selective calling. When activated, the receiver's squelch will not open unless the transmitting station sends a three-digit DTSS code matching what you have programmed in your radio. You can also transmit programmable codes for individual or group calling. The paging function of this option lets you display the three-digit code of the calling station on the front panel display. Seven memories are available for storing your own radio's code, the calling station's code during receive, and group codes or the codes of other stations.

Repeater offsets: Automatic offsets that conform to the ARRL's band plan are standard on 2m, but you can override this and enter your own offsets, if necessary. Offset selection on 70cm and 23cm must be done manually.

Tone alert: This provides an audible alarm to let you know when someone is transmitting on a frequency being monitored. When activated, this function won't actually break squelch to allow you to hear the transmission. It just beeps when a signal is received, and keeps track of the elapsed time of the signal's transmission.

Automatic power off: How many times have you forgotten to turn your mobile rig off after you left the car? Popular in many HTs, this capability in the TM-941A will turn the radio off after two hours and 59 minutes of inactivity.

Time-out timer: If you are on the long-winded side and keep timing out repeaters, this function will be especially useful. You can select 3, 5, 10, 20 or 30 minutes (or OFF for no limit) as the amount of continuous transmission time allowed before the radio automatically switches back to receive mode. A beep will let you know when the rig has reached the limit you've chosen.

Measurements Made Easy

When *73* contacted me about reviewing the Kenwood TM-941A tribander, I thought it might be appropriate to evaluate a state-of-the-art rig with a state-of-the art test instrument. I called Motorola and obtained one of their new R-2600A communications system analyzers.

The R-2600A sells for a little over $10,000, putting it out of the reach of most hams, but its versatility and many capabilities make it ideal for those involved with two-way radio servicing in the 400 kHz to 999.9999 MHz range. The 33 pound package takes the place of several pieces of test equipment. This all-in-one box serves as an RF signal generator (−130 to 0 dBm), a sensitive AM/FM measurement receiver (2 μV), scanning receiver, spectrum analyzer, duplex offset generator for servicing repeaters, frequency counter, AC/DC voltmeter, oscilloscope, wattmeter (0.1 to 125 watts), signal strength meter, frequency error meter, SINAD meter, distortion meter, FM deviation and AM percent of modulation meter, sweep generator, audio generator and a signaling simulator. This last feature includes the capability of encoding and decoding PRIVATE LINE (PL), DIGITAL PRIVATE LINE (DPL), and single tone sequences as well as multitone sequences including DTMF, two-tone paging, 5/6 tone paging, International Select V, and 20 Tone General Sequence.

The analyzer is based around Motorola's M-68000 16-bit microprocessor, and makes use of digitized screen bit mapping, softkeys and windowing, and permanent storage of common test setups. The R-2600A can even be connected to an external PC or printer.

I was able to conduct almost every test on the Kenwood using the R-2600A. In fact, except for 1200 MHz operation and actual on-air tests, the TM-941A spent most of the rest of its evaluation time connected to the communications analyzer.

Automatic band change: Suppose you have the TM-941A set to transmit/receive on 2m, but you're also monitoring 70cm and 23cm. If you wanted to transmit on, say, 23cm you would have to manually select that band to be able to transmit on it. With the A.B.C. function activated, the radio will automatically do that for you when a signal on another band is received.

Automatic lock tuning: This function is available only on 1200 MHz, and operates somewhat like an AFC. When turned on, the ALT will detect the drift in frequency of either you or the other station and automatically shift the TM-941A's frequency to compensate.

Fixed detect output: The internal microphone connector (it's behind the front panel) is an eight-pin telephone-type jack. One of its pins is labeled RD and can provide receive audio from the selected TX/RX band. By using the CONT SEL function, this terminal will be activated and can be used for packet operations.

Dimmer: The front panel illumination can be set to one of four levels of brightness.

Scanning: Here's where the magic of microprocessors really shines! The TM-941A includes "Band Scan," where an entire band is scanned in the VFO mode. "Programmable Band Scan" lets you scan a range between selected upper and lower frequency limits. "Memory Scan" covers those memory channels that are stored in a band or bank and have not previously been locked out. "Call/VFO Scan" alternately scans the call channel and a chosen VFO frequency, and "Call/Memory Scan" alternates between the call channel and the memory channel last used. "Auto Memory Scan" automatically memorizes a busy frequency (it's stored in an empty channel in bank five) while scanning a band. Kenwood also included two types of scan hold/resume functions: "Time Operated Scan" and "Carrier Operated Scan." In "Time Operated Scan" the radio will stop on a busy frequency for about five seconds, then continue scanning. In "Carrier Operated Scan" mode, the radio will stop on a busy frequency and remain there until the signal is no longer being received. After a two second pause with no signal present it will resume scanning.

Memories: Seven pages alone in the instruction manual are dedicated to the various memory functions available in the TM-941A and their operation. The rig includes a lithium battery to retain the memories when primary power is not available, and you can reset the main memories and VFO memories independent of each other. The radio has 100 memory channels for each band, divided into five banks of 20 channels.

For normal channels, each memory is capable of storing operating frequency, offset, CTCSS tone and status, frequency step, shift status, REV status, DTSS code and status, and last operation paging memory number (with the optional DTU-2). For odd split channels, the same information is stored, except for shift status and REV status. A call channel memory for your favorite frequency is also available for each band.

Adjacent memory banks can be linked to form one larger bank, and all banks can be linked. It's also possible to perform memory consolidation, where memory channels are rearranged to optimize memory scan operations. This rewrites the active memory channels sequentially, from the lowest to highest channel, without any blanks in between. Memory shift will copy the contents of a memory channel to the VFO.

Miscellaneous: Kenwood has included a "Demonstration Mode" that is described in the manual as capable of providing "a short demonstration of the capabilities of the TM-941A." I found that this was not particularly useful, since it doesn't really show how the radio works or how to use it. It's actually not much more than blinking lights and a flashing display that ends with "enjoy your hobby" before repeating all over again. When you cancel this function, the VFO memories are cleared (but not the main memories). Other features include the ability to set the beeps that the radio emits when buttons are pressed to one of eight loudness levels, including OFF; three radio LOCK functions allow disabling all of the microphone buttons (except PTT), the front panel buttons and tuning control, or all controls except the ON/OFF switch, volume and squelch. Frequency step selection includes 5, 10, 15 and 20 kHz on 2m, all of those plus 12.5 and 25 kHz on 70cm, and 10, 12.5, 20, and 25 kHz on 23cm.

In receive mode the radio is specified to draw less than 1.2 amps, and in transmit mode (high power) less than 11.5 amps on 2m, 10 amps on 70cm, and 6 amps on 23cm. F3E (FM) operation is by reactance modulation, and spurious outputs are rated −60 dBc or more on 2m and 70cm, and −50 dBc on 23cm. Maximum deviation is ±5 kHz, and transmitted audio distortion is specified at 3% or less at 60% modulation.

The receivers all use double conversion. The first IF on 2m is 10.7 MHz, 70cm is 21.6 MHz, and 23cm is 59.7 MHz. All three bands use a 455 kHz second IF. Sensitivity for 12 dB SINAD is rated at better than 0.16 μV, and squelch sensitivity less than 0.1 μV. Kenwood specifies −6 dB selectivity at more than 12 kHz on all three bands, and −60 dB selectivity at less than 24 kHz on 2m and 70cm and at less than 36 kHz on 23cm. Audio output is rated at more than 2W (8 ohm load at 5% distortion).

Table 1. RF Power Output Summaries

2 Meter Output Power (Watts)

Setting	144 MHz	146 MHz	148 MHz
HI	45.7	42.6	38.9
MID	11.4	12.0	12.5
LOW	5.2	5.3	5.4

70 Centimeter Output Power (Watts)

Setting	438 MHz	444 MHz	450 MHz
HI	33.8	33.8	32.3
MID	11.2	10.7	10.4
LOW	3.9	3.8	3.8

23 Centimeter Output Power (Watts)

Setting	1240 MHz	1270 MHz	1300 MHz
HI	10.5	10.0	9.5
LOW	0.95	0.95	0.79

Antenna connections are made to the three short cables on the rear of the TM-941A. Female UHF connectors are provided for both 2m and 70cm, and a female N connector for 23cm. The cables for the two higher bands also include plastic boots that slip over the connectors for additional protection (they're not weatherproof, however).

The front panel contains a number of controls to operate the radio. Included are a tuning control knob, volume and squelch knobs for each of the three bands, power ON/OFF, a front panel release button, and 14 other push-button "keys." Many features are controlled by functions embedded in the various keys, accessible by pressing certain combinations of keys. For example, pressing and holding the "F" key for about one second until the key indicator flashes, then pressing the "REV" key, enables the beep volume selection.

The front panel LCD display is quite impressive. It includes separate areas for each of the three bands, and each band display area has its own S/RF meter, on-air indicator, plus a host of symbols for the various functions that may be active on each band. It's possible to completely turn off one or more of the three bands, and doing so will blank the respective area of the LCD after "off" has been displayed for about 10 seconds.

The DTMF microphone supplied with the TM-941A has the standard 16 tones, PTT, UP/DOWN buttons, CALL, VFO and MR (these three duplicate the functions of their counterpart on the radio's front panel), and a PF (programmable function) button. The PF button can be programmed to perform one of 10 transceiver functions, including a MONITOR function that's not on the front panel.

Test Results

Actual power consumption was comfortably less than what Kenwood specifies. At 13.8 VDC, maximum current draw while transmitting on 2m was 9.2 amps (HI), 5.9 amps (MID), and 4.28 amps (LOW). On 70cm the figures were 7.3 amps (HI), 3.78 amps (MID) and 2.71 amps (LOW); on 23cm they were 4.18 amps (HI) and 2.52 amps (LOW). In receive mode on all three bands, the current draw was 940 mA with the cooling fan off and 990 mA with the fan running. One departure from conventional VHF/UHF mobile rigs that I've used in the past is a small fan attached to the rear cooling fins. It comes on during transmission and shuts off automatically after a minute or two in receive mode.

Using the Motorola R-2600A communications analyzer (see the sidebar), 2m receiver performance was found to be 0.15 μV sensitivity for 12 dB SINAD, 0.22 μV for 20 dB quieting, and 0.07 μV for squelch sensitivity. At 1.25 watts audio output, distortion was 1.2 percent. The receiver's performance on 70cm was equally good, with 0.17 μV sensitivity for 12 dB SINAD, 0.21 μV for 20 dB quieting, and a squelch sensitivity of 0.07 μV. At 1 watt audio output distortion was 1.3%. I was not able to make these measurements on 23cm, due to the upper frequency limit of the communications analyzer.

When I measured RF output power, I chose three frequencies in each band—one at the lower end of the band, one in the middle, and one at the upper end. The results are summarized in Table 1.

Photo B shows the purity of the TM-941A's transmitted spectrum. On both 2m and 70cm the only measurable spurious emission was the second harmonic, which was greater than 65 dB down. The Tektronix spectrum analyzer I was using has an upper frequency limit of 1800 MHz (below the second harmonic of 23cm), and within that range I could not find any spurious signals from the 23cm transmitter.

Frequency accuracy on 2m averaged a little more than 300 Hz low, and 1.3 kHz low on 70cm. I didn't measure this parameter on 23cm. Transmitter deviation with normal speech was 3 to 4.5 kHz, with the microphone two to three inches away. On-air signal reports, both simplex and through local repeaters, were rated very good by several hams. (I called up a local 2m ATV net with the TM-941A instead of my usual rig, and received glowing reports there, too.)

Comments

Kenwood has done a nice job with this radio. Squeezing three separate transceivers into one relatively small package was a formidable task, but they did it right. Even the broadband reception capability on 2m produced few problems. I listened to signals in the aeronautical bands, public service bands, etc. and found received quality to be quite good. This kind of design is sometimes susceptible to intermod, though. While monitoring certain 2m ham frequencies, I occasionally heard a paging transmitter sneak through.

The cooling fan is a nice touch; it's not too loud, but it is noticeable in the shack. In a mobile environment, vehicle and road noise easily mask it. I noticed that the radio remains warm to the touch in just receive mode, due to the amount of electronics inside the case. The temperature did not appear to increase significantly while transmitting, thanks to the cooling fan.

Very Few Complaints

I really had trouble finding things I didn't like about this radio. The use of a UHF connector on the 70cm antenna lead is not to my liking, and the demo mode in the radio really serves no useful purpose. Output power on 2 meters in the HI position was a few watts low on the rig I tested, but everything else was right about where it was supposed to be. A couple of items, like AM reception capability on aeronautical frequencies and crossband repeater operation, were not included in the instruction manual but should have been. I also noticed that the front panel latch button didn't always snap into the locked position when the panel was replaced; sometimes I had to manually lock it. The only other thing I didn't like was having to return the radio after the evaluation! The real question, though, is how long before they put this triband technology into an HT? 73

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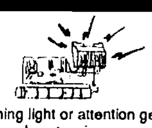

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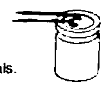

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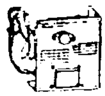

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The Three-Terminal Regulator

Multiple uses in one package.

by E.R. Doubek N9RF, P.E.

Since the three-terminal voltage regulator was first developed to permit local voltage regulation, it has found a place in both commercial and home-built products. With improved regulation, the circuit designer doesn't have to run heavy power leads between the power supply and the load or design for remote sensing at the load. Not only does the three-terminal regulator do a nice job of regulating voltage, it also ensures a lower power supply impedance, which helps to handle transient current spikes. See the table for a list of the most common, low-cost, and readily available three-terminal fixed and adjustable voltage regulators.

Normally, these regulators do not require additional components to generate a regulated voltage. The device is simply placed so its input terminal is connected to a source of voltage at least 2 volts above the regulator's rating as long as you don't exceed 35 volts. At voltages above 35 volts, the unit may be destroyed. The output terminal delivers the voltage corresponding to the ratings shown in the table. The third terminal, GND, is a reference for the regulator. Normally, a current under 10 mA flows in the GND lead. It may be connected to a reference voltage source, the output of another regulator, or to ground.

Advantages of the Regulator

Figure 1 shows possible connections for different uses. If the regulator is located some distance from the power source, a 0.25 to 1.0 µF capacitor may be connected from the input terminal to ground. This improves transient response and helps prevent regulator instability. You can put a capacitor from 0.01 to 1.0 µF from the output terminal to ground to help control the spikes most logic circuits generate. Keep in mind that the source of input power must be capable of supplying a greater voltage than the output of the regulator under a load of at least 1.5 amps. The regulator is internally protected to prevent damage in case the unit becomes too hot or the load too high.

Another reason for using three-terminal voltage regulators is that they protect against shorted components on a circuit board that could be damaged because of insufficient fusing and small printed circuit conductors.

The LM317T voltage regulator, adjustable for voltages from 1.25 to 37 volts, requires a few external components. See Figure 5 for a typical circuit application. It has a line regulation of 0.01%/volt and a load regulation of 0.1%. The ripple reduction is typically about 80 dB, a significant figure.

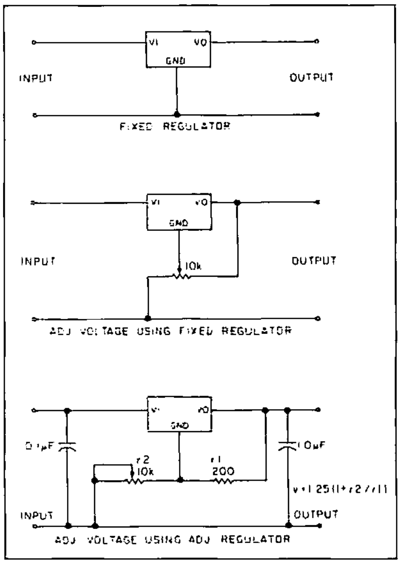

Figure 1. Three-terminal regulators may be fixed or adjustable.

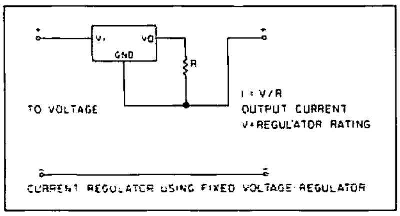

Figure 2. Add a resistor and this connection, and you can use your fixed regulator as a current regulator.

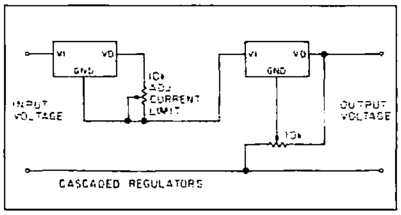

Figure 3. Cascading a current regulator and a voltage regulator adds flexibility and circuit protection.

Regulating the Current

By adding a resistor and the connection shown in Figure 2, the same fixed regulator can be used as a current regulator. With this circuit, you can calculate the value of the regulated current from this simple equation: **R** = **V/I**, where **R** is the value of the programming resistor, **V** is the value of the regulator voltage, and **I** is the value of the desired current level. With this circuit feeding a lamp load, the life of the bulb can be greatly increased, since the inrush current with a cold filament is limited.

You can also use this circuit for battery charging, when you want to charge at a fixed rate regardless of the terminal voltage to the battery.

This circuit has also been very successfully used as a stable bias source for transistor circuits and as a driver for LEDs. In many cases, the LED output is more easily controlled by regulating the current through the diode instead of controlling the voltage impressed across the diode. This difference may be especially important in circuits for battery operated infrared-emitting devices.

If the resistor is adjustable, the circuit can nicely control the speed of a small DC motor (of the type often used in some instruments) without a large wattage series resistor.

Charge a capacitor from a constant current source and the result is an interesting capacitor ramp generating circuit. The ramp is linear. You can also use this circuit to provide a constant current source for making a 4-terminal resistance measurement.

Continued on page 58

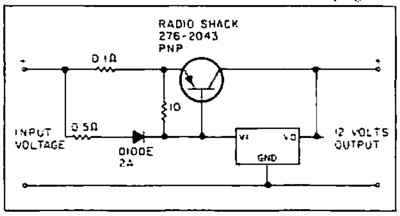

Figure 4. Here's a better way to handle increased current.

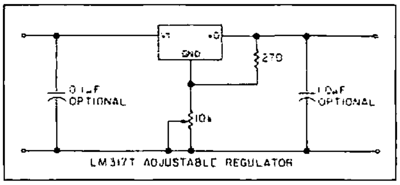

Figure 5. The LM317T adjustable regulator requires some external components.

Rose Parade Mobile

A high-tech HF remote station.

by David R. Corsiglia WA6TWF

The 101st Tournament of Roses Parade provided a unique opportunity for amateur radio to contribute to the 1989–1990 parade theme, "A World of Harmony."

The hundreds of hams who provide communications support to the parade each year were joined this time by Bill Fedde KC6GSD. Bill contacted hundreds of hams by operating a mobile station while riding in a vintage car in the parade. (KC6GSD will again operate Rose Parade Mobile. See the sidebar.) The son of Don Fedde, the 1989–1990 Tournament of Roses president, Bill was seen by the four million television viewers and one million spectators who lined Colorado Blvd. in Pasadena, California, on New Year's Day.

Photo A. Bill Fedde KC6GSD working Rose Parade Mobile. (Next to driver, waving hand.) Notice the headset and whip antenna.

Bill used a concealed hand-held radio broadcasting to an ultra-sophisticated remotely controlled transceiver coming out on 28.333 MHz. These remotely controlled transceivers are connected to a repeater through a low-band, computerized interface controller. Most stations contacted said that Bill's signal was S9+ through the remote station. Many stations contacted in Europe had excellent signal readings.

The TWF Super System

The plan originated when Bill, a recent graduate of Gordon West's Radio School, mentioned to Gordon WB6NOA that he would be participating in the Rose Parade with his father. Gordon had recently joined the TWF Super System, a remote base system with the capability of going in on 440 MHz and coming out on any band from 80 meters to 440 MHz on sideband or FM. With this technology and equipment available to Bill, the serious planning began.

The TWF system has three of these remote systems in operation in the Los Angeles basin. Each station operates with the most up-to-date equipment, giant antenna systems, and kilowatt amplifiers. The station that Bill used for the parade is on a one-thousand-foot hill overlooking the parade route. It uses Kenwood TS-940, 711, and 811 transceivers, and a 4-element KLM tribander on 10, 15, and 20 meters (see Figure 4 and Photo B).


Photo B. David Corsiglia WA6TWF demonstrates the TWF Super System.

As a new ham, Bill had never participated in operating a DX or special event station before. Gordon tutored Bill and conducted mock contesting drills. Even though hundreds of stations called Bill, everyone was courteous and the check in's proceeded in a well-organized manner. Three net control stations helped hold the frequency before the event started and kept a log of all stations heard. Reel-to-reel tape recorders were used to log the whole event so no one was left out.

Bill and Gordon sent press releases to more than 40 news-gathering organizations. The 90 television cameras along the parade route offered on-the-air close-up pictures of the president's car. Bill could be seen next to the driver with his headset on, contacting hams throughout the world.

To counteract the problem of the dual-band hand-held radio running out of power, a 4 Ah gel cell battery was installed and an external power cord was used. A mag mount antenna was camouflaged with flowers by a volunteer group from Holland that decorates the officials' cars in the Rose Parade each year.

The World at Your Fingertips

The brain of the TWF system is a low-band interface controller designed and built by K6QE Systems. This controller allows any mobile operator to control the band, mode, and exact frequency, and also to rotate the antenna to the desired setting from a hand-held radio or mobile using touch-tone commands. Other features include automatic antenna switching and frequency scanning.

The audio is so good that most amateurs contacted through the system don't realize they are talking to someone using a remote transceiver. K6QE Systems had already adapted the controller for the Collins KWM-380 and Yaesu's FT-980 and 767. Now it has adapted the controller for the Kenwood 940.

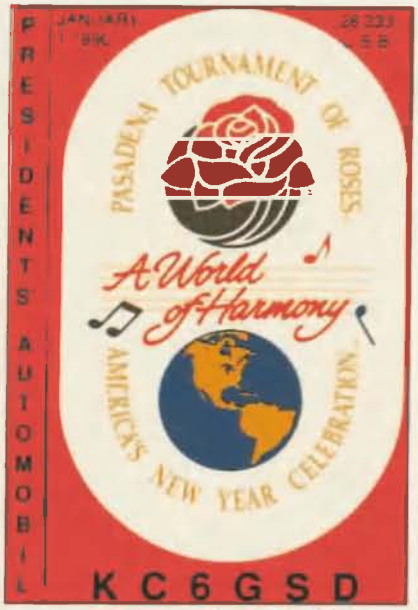

Figure 1. QSL card from 1989-1990 Rose Parade Mobile.

Jim Gilliam, designer of the K6QE Systems' low-band interface, says he is going to standardize the adaptation on the Kenwood radios for future units.

One of the main difficulties with having a computer control a worldwide transceiver is keeping the computer-generated noise out of the receiver. A special set of shielded boxes had to be custom-manufactured to enclose the commercial Micro-Mint computer board.

Repeaters connected to a low-band interface system have allowed many hams in the Los Angeles basin encumbered by antenna restrictions access to a superb worldwide station at their fingertips. They can make rare DX contacts as well as enjoy general ragchewing.

Nancy Bucher N6XQR is one user of these new remote stations. She says it doesn't make sense for her to invest a lot of money in an expensive HF radio because she lives in a very restrictive town house project and can't put up any decent antennas. So she joined a repeater group that has a low-band interface, and now she can come out on 20 meters, just like the big DXers. Nancy uses only a small hand-held 440 MHz radio.

Dan Fort AA6LM, operating bicycle mobile, talks to hams all over the world on 1 watt. Dan is a member of the TWF Super System which allows him to go into the repeater on 440 MHz and be rebroadcast out on all the HF frequencies using kilowatt amplifiers.

If you have an interest in this technology, please write me at the address given at the end of this article, or call me at (714) 535-5528.

For inquiries on Bill Fedde's operation in the up coming Rose Parade, please write Bill Fedde, 394 Jones St. Ventura CA 93003, or call him at (805) 643-1817.

Figure 2. Ultra Comshack 64 Repeater Controller with some of the various boards available.

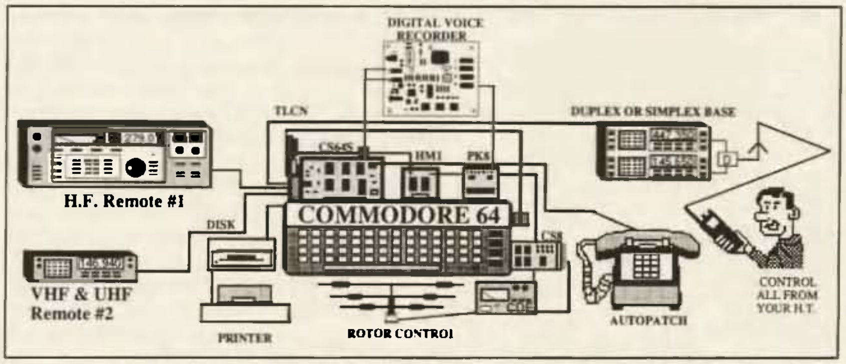

Figure 3. Block diagram of Ultra Comshack 64 Repeater Controller.

The Super Station

A hand-held radio plus a repeater with a remote transceiver equals a super station. The remote system Bill Fedde uses for the Rose Parade is part of the new wave of sophisticated repeater systems that are connected to amateur HF radios.

These repeater controllers are very smart and can perform just about any tuning function of the remote HF radio that an on-site human operator can do. For example, Bill can push a few touch-tone buttons on a 440 MHz handheld and come out on 20 meters USB and talk halfway around the world.

Groups of hams around the U.S.A. are pooling their resources and putting up these stations in areas such as industrial parks, where they are unencumbered by antenna restrictions. One such system in Santa Ana, California, is using a Kenwoood TS-940 transceiver. This group was able to erect a 6-element KLM tribander on one tower and a 3-element 80 meter beam on another tower not subject to residential zoning ordinances.

Although many manufacturers make repeater controllers that activate UHF and VHF radios, very few companies at this time sell units that control HF radios. Two companies that do are Engineering Consulting and K6QE Systems, both located in Southern California.

The Engineering Consulting Ultra Comshack 64 line of controllers consists of a series of circuit boards (Figures 2 and 3). You can pick and chose from various boards for the features you want. The basic starter board is $379.95, but a super deluxe system in a 19" rack enclosure with every option would run approximately $2,500.

The Ultra Comshack 64 will work with most computer-controlled radios on the market today. A combined dual-remote control system allows two transceivers to be controlled at the same time. For example, one for for HF and another for VHF. The control operator has tremendous capabilities to remotely change any parameter of the station, such as length of phone call, time-out timer,

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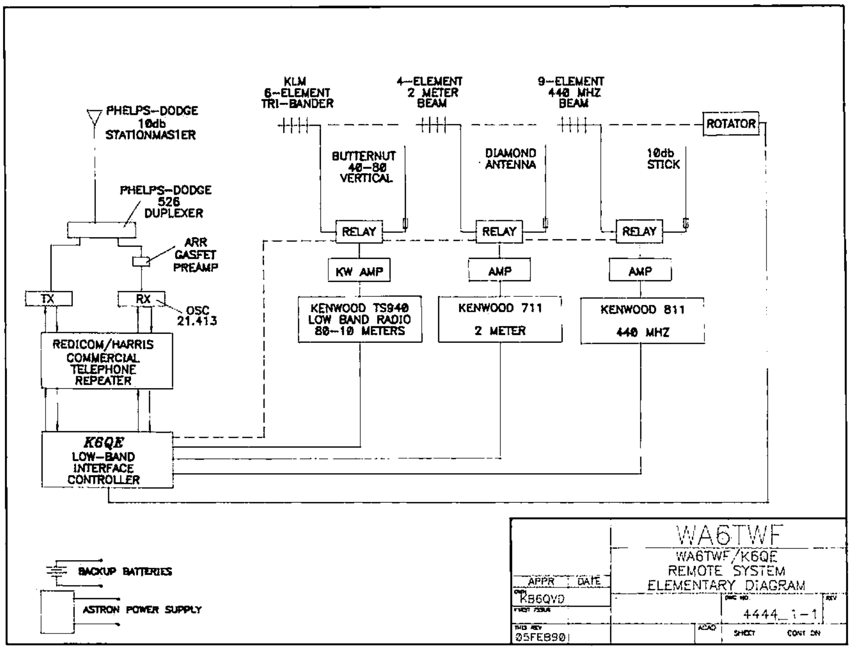

Figure 4. Block diagram of the TWF Super System.

etc. The system, which runs on 12 volts DC, can be remotely programmed by touch-tone, packet, or modem.

The Ultra Comshack 64 can use any FM radio as a primary input/output device. A repeater is not necessary. You can use a simplex channel or a dual-band transceiver in a crossband mode. The Ultra Comshack 64 includes complete programming, but it's an experimenter's delight because you can custom-tailor hundreds of commands with macros. You can truly have it your way with an Ultra Comshack 64. If you want one thousand autodial numbers and a talking S-meter, you can have it. The list is endless!

K6QE Systems manufactures a deluxe low-band interface controller. This is a turn-key system; just take it out of the shipping container and hook up the supplied plug-in cables to your transceivers. You can have up to five transceivers. There are also cables for the repeater and a rotator control box. Turn it on, and you're on the air.

The unit has a voice storage command feedback system that sounds so real you would swear that a human voice is speaking to you. The controller will not let the user transmit out-of-band accidentally, and it knows USB is normally used on 20 meters, although it can be forced to LSB. The K6QE low-band interface uses a built-in commercial micro-mint computer. The unit operates off of 110 volts AC and works only with the Kenwood line of radios (TS-940, 911, 811).

Features Common to Both Units

Both units have a telephone accounting system which allows individual access codes for each user. The control operator can request a hard copy printout via modem of the past month's telephone activity including, but not limited to, the number dialed by each access code, length of call, date, and time. Both units also have full low-band remote functions you can access from any touch-tone phone. For example, you could be at work pretending to be on an important business phone call and really coming out on 20 meter USB, working that rare DX contact you would have missed otherwise.

Both manufactures supply excellent documentation and a 90-day warranty. K6QE Systems offers a one-hour VHS video on their system, and on remote bases in general. The $39.95 charge for this tape is refundable if you purchase the unit.

Comshack users can tune in to the Comshack Remote Base Net that meets Sundays 1100 PST on 14.275. Bob Blumenkranz NI6R is net control.

For more information about the Comshack system contact: Engineering Consulting, 583 Candlewood St., Brea CA 92621, tel. (714) 671-2009; for information about the K6QE controller contact: K6QE Systems, 2180 W. Crescent Ave., Suite F, Anaheim CA 92801, tel. (714) 991-1439.

KC6GSD Goes One Better

This year Bill Fedde KC6GSD will be working Rose Parade Mobile again, but from a parade float this time. Bill has arranged to hitch a ride on the Rand McNally float, and he will be able to make contacts throughout the journey down the Rose Parade route.

Alinco Corporation has donated a DR-590T dual-band mobile transceiver with remote tuning head for this special station. This type of radio was needed because of the limited mounting facilities on board the float.

Bill wants to have complete access to the tuning controls of the radio so he can switch from 2 meters simplex (144.330) for working local spectators with their hand-held radios, to 440 MHz to access a K6QE systems remote station to come out on 28.333 MHz.

Gordon West WB6NOA is helping Bill with a special headset for the parade. A dual--

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Work a Rose Parade Float!

This year the Tournament of Roses will have a "super station" operator (KC6GSD) on board one of the floats, so be sure to tune in to 28.333 MHz and talk directly with the station yourself. "Alinco is working closely with David Corsiglia WA6TWF to set up the right type of equipment for this operation, so our signal into the remote base on UHF should be very loud and clear," says Gordon West WB6NOA.

Classroom comments usually go like this: "Right, Gordo, you're telling me this handheld is reaching all the way to a station in Japan—sure, tell me more . . . ."

To the newly licensed amateur radio operator, capabilities of remote-based operation are best summed up by one student who said, "Amazing, simply amazing!" And it is. How many times have you walked down a busy street, chatting on your handheld, in QSO with a station thousands of miles away? The remote base makes this all possible.

The "WA6TWF super system" also provided Gordon West ham class students with 10 meter code practice covering all of Southern California and, on most evenings, blanketing the entire central states and East Coast with rock-solid signal strengths.

Every Monday evening between 6 p.m. and 8 p.m. Pacific Time, an on-the-air code class is offered on 28.333 MHz. Simply dial up 28.333 and tune down a few kilohertz until you find the familiar sounds of a Morse code class on the air. But unlike Morse code generated for on-the-air practice, Gordon West narrates on the same frequency that the code is being sent on. And since the code is sent at 28.333 in the Novice code and voice portion of the band, narration is indeed practical and possible.

Gordon West, recent ARRL "Instructor of the Year" award recipient, best known for his humorous code and theory training tapes, says, "We will send code for about three minutes, then ask any student on 10 meters for a read-back. It really gets everyone involved. And when conditions are just right, it's not surprising to get a read-back from stations down in South America or as far west as New Zealand.

"This unique style of code class also allows me to stop and answer questions students may have. Nowhere else on the dial can anyone find this type of 'two-way' code class, and I think we have hundreds of one-way listeners, too, tuning us in on the UHF band with their programmable scanners."

West uses an equalizer and audio system to combine both modulated CW and voice. The code is generated by a Bencher paddle tied into an AEA Morse Machine, and the MM-3 may also take code directly from a Radio Shack Model 100 lap-top computer. The MM-3 has the latest revision which allows the computer-generated input to be sent at 15 or 18 wpm character rates. The ARRL uses 18 wpm character weighing, where most other examination teams use the more traditional 15 wpm character weighing. Either way, the MM-3 or Gordon West on the paddles can easily handle both types of CW.

A Kenwood 721 transmits the voice and modulated CW on the 440 UHF band to a repeater 60 miles away on the Palos Verdes Hill. The repeater retransmits the voice and code on UHF, and also feeds the big Yaesu base station. Via the WA6TWF remote-base system, the base station may be remote-controlled to transmit on 10 meters, and also to listen on 10 meters, to feed the received student responses back down on the UHF link. This allows West to monitor both 10 meters locally and 10 meters from the remote base. A 70-foot tower and tribander, located at an altitude of 1400 feet above sea level, commands a signal that can be heard in the Los Angeles basin as well as thousands of miles away. Beam heading is generally to the east, but if enough students are calling in from Australia, New Zealand, and Japan, the beam may be remote-controlled to the west.

"The system works terrific—about the only thing that causes us a problem is a nearby military radar installation that puts a buzz on the UHF link. And from time to time we have someone come on the 10 meter band to inform us that our CW sounds a little strange. After we let them know it's modulated CW coming from a UHF link, the 10 meter operator can get the idea of what's going on, and generally stays tuned in.

"And it's our guests tuning into code practice that makes everything really work well—many times guests will transmit their own version of code practice, and our students love it. We welcome everyone to not only listen, but to take part in this 2-hour code class, on the air," says West.

West occasionally uses the WA6TWF remote base for his Tuesday morning contact with the "CQ All Schools Net" found on 28.303 MHz (every Tuesday and Thursday at 12:30 p.m. EST). He links up with Carole Perry WB2MGP, and the coast-to-coast stations provide schools all over the country with a look into ham radio in live operation.

It's best summed up, as one of Gordo's students has said before, "Amazing, just awesome amazing!"

band antenna will be camouflaged in the flowers of the float.

A commemorative QSL will be available to anyone who hears or works Bill. For your QSL, send a self-addressed stamped envelope to: 102 Tournament of Roses (KC6GSD), 391 South Orange Grove Blvd., Pasadena CA 91184.

So on January 1, 1991, New Year's morning, turn your radio to 28.333 MHz and give KC6GSD a call. Bill will be detailing his progress down Colorado Blvd. Turn on your TV, also, because he will point out when he is in front of the TV Cameras. 73

David R. Corsiglia WA6TWF, 858 Lenz Drive, Anaheim CA 92805. (714) 535-5528.

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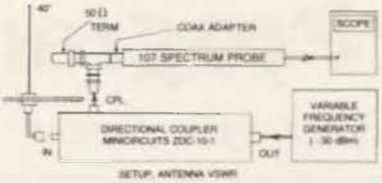
evaluating an
ANTENNA (MATCH)

FIG. 9



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446MHz 500 watts
1200MHz 20 watts
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146MHz INPUT: UHF
446MHz INPUT: N-type
1200MHz INPUT: N-type

■ CFX-4310
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CIRCLE 237 ON READER SERVICE CARD

73 Review

by Bill Clarke WA4BLC

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The wind is blowing and the rain is pelting the old radio room window, but today I am going to design and test a new antenna. Of course I'm not going out in that wet weather to do antenna work. And, I'm not even going to cut a wire or solder a connection.

How, you ask? Simple. I'm going to model my newest antenna idea on a computer. How about that, folks—a use for a ham's computer other than packet!

Enter MININEC by J.C. Logan and J.W. Rockway of the Naval Ocean Systems Center, a comprehensive antenna modeling program. Roy Lewallen W7EL has used the fundamental computation portion of this program to produce ELNEC, an antenna modeling program for the IBM-PC computer and its clones. Roy began writing ELNEC over two years ago for his own purposes, saw its value to other hams, and introduced it to the public in May 1990.

The ELNEC Program

ELNEC is a computer program for the modeling and analysis of radio antennas. Basically, modeling consists of the generation of the antenna's far-field pattern (radiation pattern). This includes gain, which can be plotted in the typical ARRL-type grid style or presented in tabular form. (The latter is for folks who don't have graphics capabilities.)

If for no other reason than using ELNEC, get a graphics card and monitor for your computer. The first time you use it will more than pay for this cost. After all, you can get an "el cheapo" board and monochrome monitor for under a hundred dollars.

Features

ELNEC is user friendly. It uses a menu-based system that is easy to understand and interact with.

All outputs of ELNEC can be printed, giving you a hard copy of your efforts for later use and analysis. ELNEC's features include the ability to analyze forward gain, front-to-back ratio, beam width, 3 dB pattern points, side lobe information, SWR (50 or 75Ω systems), voltage, current, impedance at source points, and current distribution along the wires.

A unique feature is its TOTAL pattern generation. A total pattern is a combination of the vertical and horizontal components of the radiation pattern, and shows exactly what you may expect in real operation.

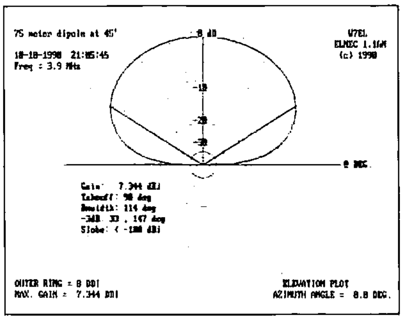

Figure 1. This 75 meter dipole at a height of 45 feet shows a typical elevation pattern. Note the straight lines within the pattern—they are from the ANALYSIS feature and depict the 3 dB beam width. Printed just to the lower left of the pattern's center is the analysis showing beam width information. Specifically, the −3 dB points of 33 and 147 degrees. Note that the pattern is labeled in the upper left corner for future reference.

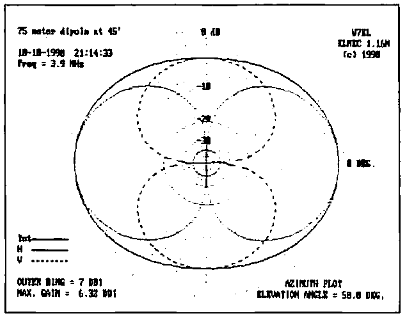

Figure 2. The same 75 meter dipole in a combination plot showing horizontal, vertical and total patterns. They are based on an elevation angle of 50 degrees, taken from within the 3 dB beam width of Figure 1. Of particular importance is the TOTAL pattern, a combination of vertical and horizontal fields.

Simple and complex antennas can be modeled, as can structures such as towers and walls, and the surrounding ground characteristics can be introduced. The combinations of these factors can produce surprisingly accurate far-field patterns.

Although most types of antennas can be modeled, program coding limitations of MININEC cause some minor limitations shared by ELNEC and other MININEC-based systems. Specifically: Closely spaced wires such as transmission lines are difficult to model (however, they are possible); you cannot determine the efficiency of a ground radial system; and impedances given for horizontal antennas lower than 0.2 wavelengths will not be correct. However, far-field patterns will be accurate.

A Small Package

ELNEC comes in two forms, one for the computer with a math coprocessor, and the other for the poor folks like me that have no coprocessor. Installation in either case is a snap. Just make a backup of the original disk and use that backup as your operating disk. Of course, as there is no copy protection used in ELNEC, you can install the system on your hard drive.

The program's documentation file is located on the distribution disk and should be printed and read **BEFORE** you try to use ELNEC.

ENSETUP is a short set-up program that allows some parameters to be modified during installation. These specifically include printer type, file paths, date format, and color selections.

Included in the instructions is a "test drive" to lead you through what ELNEC can do. It is based upon a 20 meter dipole 30 feet in the air. These instructions run for several pages in the manual and will allow you to touch and feel that dipole in every conceivable manner via ELNEC.

After the test drive is completed, you will probably wish to proceed with antennas of your own design.

Roll Your Own

All antennas designed for ELNEC are based on straight wires (of any size definable) placed on a three dimensional grid (X, Y, and Z three dimensional axes). Loops and circles are modeled as combinations of many straight wires. Using graph paper will aid you during the first few tries, which will show you how really easy antenna modeling is.

Let's take a dipole as an example. A good starting point would be the dimensions, which in this case are going to be cut for 3.9 MHz, and the height will be 45 feet. Using the XYZ grid, start at 0,0,45 (meaning in the center of the imaginary or real graph paper at a height of 45 feet). Next, enter the end of the dipole as

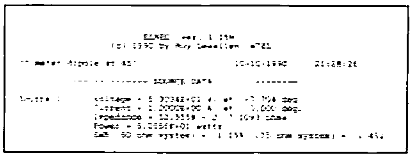

Figure 3. Source data for the 75 meter 45-foot-high dipole shows voltage, current, impedance, power, and projected SWR.

0,120,45 (notice the antenna is 120 feet long and goes from the center of the graph towards the top). The feedpoint would be entered as the source in the form of a percentage from one end of the wire to the feedpoint, in this case 50%.

Now select the type of plot you want for the dipole, azimuth or elevation, and press ENTER to calculate (see Figures 1, 2, and 3).

Observations from Use

Most of my modeling has been over what ELNEC refers to as "real ground." This allows you to customize the ground parameter of the program with your actual ground conditions (conductivity, etc., as referenced in the *ARRL Handbook*). Modeling can be done over perfect ground or in free space. I prefer to see what the real world operation of the antenna will be, so my modeling is over real ground.

While using ELNEC, and similar programs, I have found they all spit out gain figures that are extremely enticing to the uninitiated. For example, look at Figure 4 (20 meter, 3-element beam at 70 feet) and you will see the gain figures in the lower left corner. Pretty impressive, huh? Don't you believe it! That 12.88 dBi can be very misleading, just as the claims of some antenna manufacturers can be misleading.

ELNEC bases its gain figures (as do the antenna manufacturers) on dBi, decibel gain relative to an isotropic source. These figures are as theoretical as is the isotropic source, but they do provide a standard point with which to compare antennas.

For a real look at what this beam antenna can do, model a simple dipole at the same location (height) for use as a reference. Next, check the dipole's gain of 7.63 dBi (Figure 5) against that of the beam (12.88 dBi). The difference will be the expected improvement using the beam versus the dipole. Of course, that gain is only exhibited in specific directions, as shown in the pattern of Figure 4.

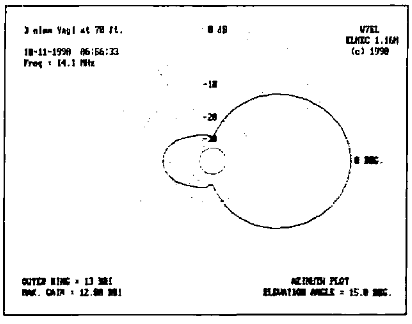

Figure 4. Total pattern of a typical 3-element yagi cut for the 20 meter band. Note the gain figures and angle of the plot.

Remember, the object of a directional antenna is to concentrate your signal (received and transmitted) to planned horizontal and vertical directions.

All-Purpose Antenna

In the hunt for the illusive all purpose antenna, I always think of the center-fed zepp. The version modeled here, using ELNEC, is 60 feet on either side of the feedpoint and is horizontal at 45 feet in the air. It is fed with 450Ω ladder line.

On 75 meters the antenna behaves as a dipole. However, as the frequency is increased, there is some directional gain.

The 17 meter plot of the zepp (Figure 6) shows how the directional pattern appears at 15 degrees elevation, which is excellent for DX. Of course, the pattern can be oriented to favor any specific geographical area simply by moving the antenna's azimuth position.

Other antennas, such as the Carolina Windom from the Antenna Works and the G5RV,

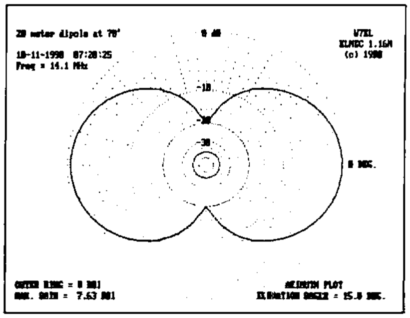

Figure 5. A dipole can be used as a standard of comparison when modeling experimental antennas and will tell you immediately if you are winning or losing the battle. Note the gain figures and angle of the plot. The dipole is placed at the same height as the beam it is being compared with.

exhibit similar pattern characteristics and are excellent for use on all bands.

An Experimental Antenna

In my personal search for an antenna for 75 meters that would reach from my New England QTH into the far southeastern part of the U.S., I designed a directive array using a dipole at 40 feet with a sloping 75 meter delta loop 20 feet behind it. The loop is 88 feet on each of its three sides and is fed in the center of the section that parallels the dipole. The parallel (to the dipole) section is at 35 feet and the far point is at 10 feet. Figure 7 shows the resulting plot at 50 degrees elevation (the plot holds from 40 through 60 degrees). Compare the plot and figures with Figure 2.

This antenna is still theoretical, as I have yet to put it up. Such is the problem of moving from one QTH to another.

Likes

1. ELNEC is considerably faster in operation than similar programs I have used in the past.

2. Print drivers are included in the ELNEC system, making "screen dumps" unneces-

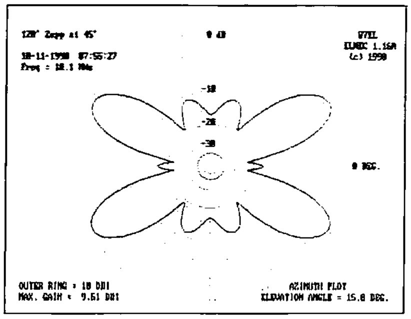

Figure 6. The zepp as it appears on 17 meters (a dipole cut for 17m would produce a similar plot as Figure 1).

sary for printing hard copies.

3. There is no copy protection (see comments later in this article).

4. The guarantee is "like it or leave it." If you're not satisfied with the program, your money will be refunded.

5. On an EGA or VGA color display you can select the colors that will be used to display various patterns (horizontal, vertical, total, etc.). CGA and monochrome displays offer no color option with ELNEC.

6. The ANALYZE feature of ELNEC quickly determines beam widths and 3 dB directional (horizontal and elevation) limitations.

7. Minor changes to parts of an antenna's description do not require complete recalculation by ELNEC.

Dislikes

1. ELNEC, in the version tested, does not save plots to files. You have to recalculate each time you wish to review a specific antenna. I make printed copies of each design, so this isn't a major inconvenience.

2. The times to complete calculation estimates (shown on the screen) are not accurate.

Copy Protection

ELNEC gets a big "Thumbs Up" for NOT being copy protected! Although it is copyrighted material, the purchaser may make copies for backup use only.

For my personal applications, I find programs that use any form of copy protection to be a nuisance at least, and disastrous at worst. Being able to make workable backup copies of purchased software is very important, as disks do crash and programs do get destroyed. *Continues on page 54*

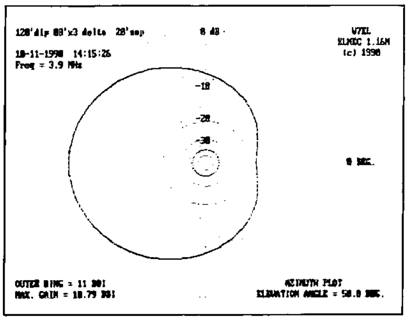

Figure 7. The 50 degree plot for the 75 meter dipole and delta loop combination.

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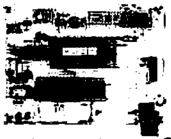

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ELNEC

Continued from page 53

Recommendations

Do I recommend ELNEC to my fellow hams? Yes! After testing hundreds of designs, I do recommend ELNEC. However, I also offer these caveats:

ELNEC, and other complex antenna programs, require a reasonable understanding of expected RF patterns and basic antenna design. They cannot be expected to answer all antenna questions within the first few hours of operation.

Additionally, when you begin designing antennas you will find yourself making many changes and more and more calculations. The result is that you will be spending more time on the computer and less time on the radio. You will be conspicuous by your absence from the bands. 73

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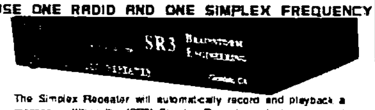

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by Phil Salas AD5X

For less than $25, you can have a mag-mount antenna base with low-loss coax, a 144/450 MHz dual-band antenna, a 13" 10 meter antenna, and a half-wave 825–890 MHz cellular antenna. How?

Recently I was looking through an electronics parts catalog (Marlin P. Jones & Associates, tel. 407-848-8236) and found high power ferrite toroid magnets with attached steel base plates for use as magnetic mounts for mobile antennas. They were only $2.75 each. I'd been wanting a mag-mount base with BNC connector so that I could attach my HT antenna to it while mobiling. This looked like a good foundation at a good price. Constructing the mag-mount led to antenna experimentation and construction.

Magnetic Mount Construction

See the Parts List for the parts you can order from Marlin P. Jones & Associates. You'll also need to buy an 8-32 x ⅜" brass screw and two ⅞" copper pipe caps, for a total of less than 50¢, from your local hardware store. The two pipe caps are shown in Figure 1(a). One has a ⅞" outside diameter and the other has a ⅞" inside diameter. One will slip inside the other.

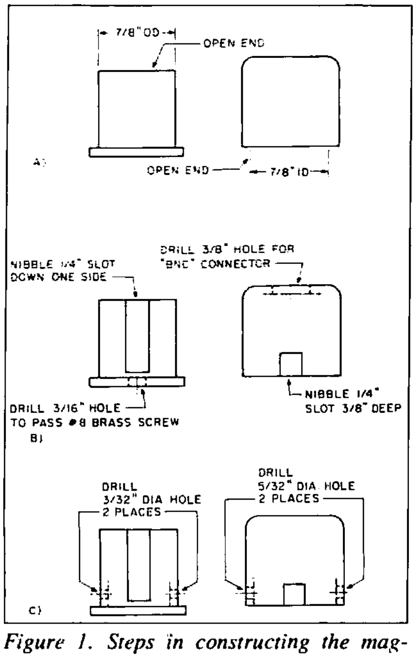

Figure 1. Steps in constructing the mag-mount.

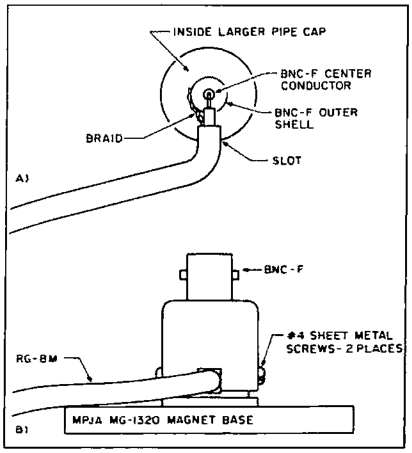

Figure 2. Installing and securing the coax to the mag-mount.

Nibble a ¼" slot ⅜" deep in the larger pipe cap as shown in Figure 1(b). Nibble a ¼" slot all the way down the side of the smaller pipe cap. Next, drill a ⅜" diameter hole in the center top of the larger pipe cap for the female BNC connector, and a 3/16" diameter hole in the center of the bottom of the smaller pipe cap for the #8 brass screw. Insert the brass screw so that its head is inside the pipe cap, then solder it in place. Be careful not to get solder on the outside threads of the screw.

Now drill two 5/32" holes near the bottom of the larger pipe cap, as shown in Figure 1(c). Slip the large pipe cap over the smaller pipe cap, align the slots, and mark positions for two holes in the smaller pipe cap. Remove the larger pipe cap and drill two 3/32" holes in the smaller pipe cap.

Insert the female BNC connector in the ⅜" hole in the top of the larger pipe cap, attach its mounting screw, and tighten in place. Now strip ½" off one end of a 14-foot length of RG-8M coax cable. Unravel the braid and twist and tin the braid and the center conductor. Refer to Figure 2(a). Rest the coax cable in the slot in the larger pipe cap and see where you can make the braid come in contact with the outer shell of the BNC connector. Tin the connector shell at this point. Now solder the center conductor of the RG-8M cable to the center conductor of the BNC connector. Tin the connector shell at this point. Now solder the center conductor of the RG-8M cable to the center conductor of the BNC, and solder the RG-8M shield to the outer shell of the BNC.

Now slip the larger pipe cap (with the RG-8M cable attached) over the smaller pipe cap, and push them together so that the small holes in the base are in line. Screw two #4 x ¼" sheet metal screws through the holes and tighten. Finally, pass the brass screw threads through the magnet base and tighten in place with a #8 lockwasher and nut, as shown in Figure 2(b).

To finish the assembly you need to attach the BNC crimp-on connector to the other end of the RG-8M cable. You'll find that the stranded center conductor of the RG-8M cable is too big to fit into the center pin of the connector. Just cut off all but three strands, then insert these strands into the center pin and solder them in place. Crimp the outer shield collar in place, as in Figure 3.

I used a hot glue gun to seal up the gaps in the base where the coax cable exits from the

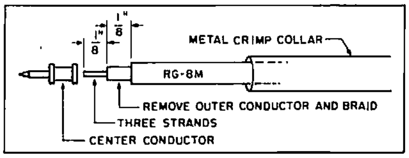

Figure 3. Crimp the outer shield collar in place, and you're finished.

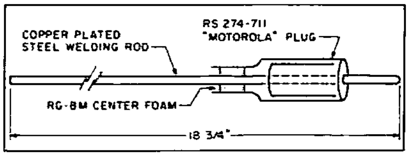

Figure 4. Dual-band 2 meter/450 MHz whip construction.

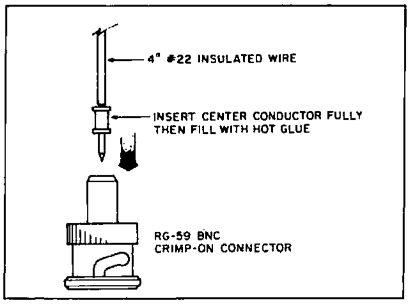

Figure 5. BNC adapter for the 10 meter antenna.

copper caps. I also put a bead of hot glue around the lip between the two copper caps.

Your mag-mount base is now complete. You can attach your HT antenna to this base and get significantly better performance than you can from using the HT antenna alone from within the car.

144/450 MHz Dual-band Antenna

I thought I could probably get better performance with an antenna larger than the 6" antenna on my FT-727R HT. Since a ¼-wave antenna at 2 meters should be close to a ¾-wave at 450 MHz, I decided to find a compromise length that would work for both bands. The result is shown in Figure 4.

This antenna is made from a piece of 0.09" (3/32") diameter standard copperplated steel welding rod. The rod costs about 20¢ for a 36" length. Use a file to round one end of the rod so that it will slip into a Motorola-type automotive radio connector (Radio Shack part number 274-711). Before sliding the rod into the connector, tin it well. Unless the end of the welding rod is well-tinned, you'll have difficulty soldering the rod into the connector.

Once the rod is soldered into the connector, press a ½" length of the center foam insulation from a piece of RG-8M over the welding rod and slide it so that it supports the welding rod in the connector as shown. Cut the welding rod to 18¾", as shown in Figure 4. Now insert the connector into a male BNC to female Motorola adapter (RS# 278-117). Place a piece of ½" heat shrink tubing over this assembly and heat it. When it has cooled, you will have a rugged antenna assembly.

With these dimensions, the antenna has less than 1.5:1 VSWR at 445 MHz, and less than 2:1 at 146 MHz. You can vary the length slightly if you wish to favor one band over the other, but you'll find negligible improvement in performance. In any case, performance will be significantly better than with the HT antenna alone.

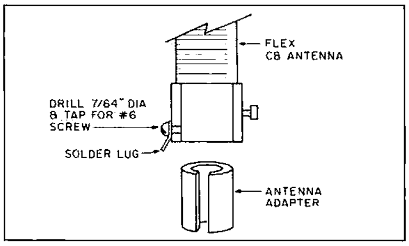

Figure 6. Modification of the CB walkie-talkie antenna mount. Drill a 7/64" hole close to the bottom of the antenna base and tap it for a #6 screw.

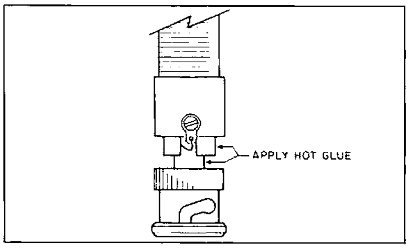

Figure 7. Attaching the BNC connector to the 10 meter mobile antenna.

13 Inch, 10 Meter Antenna

I have a converted CB rig in my car for 10 meters. Naturally, I wanted a small antenna for this rig, one that would be secure at highway speeds, so that I could attach it to the mag-mount. Radio Shack sells a flexible CB walkie-talkie antenna (RS 21-980, for $7.95) which, with a little work, will cover part of the 10 meter band.

Since we have to interface with a BNC connector, let's start with building the BNC adapter for the antenna. Refer to Figure 5. Solder a 4" length of insulated wire to the center pin of an RG-59 crimp-on connector. Insert the center pin/wire combination into the connector and fill the sleeve with hot glue to keep the center conductor pin firmly in place.

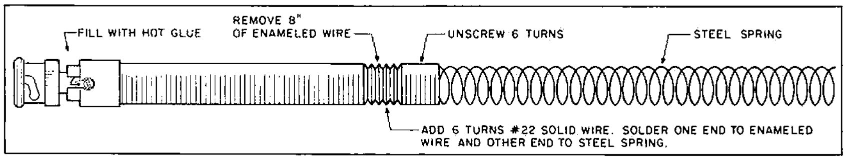

Figure 8. Modifying the Radio Shack CB walkie-talkie antenna for 10 meters.

Referring to Figure 6, drill a 7/64" hole close to the bottom of the antenna base and tap it for a #6 screw. Use a 6-32 x ¼" screw to attach a solder lug to the base at this point. The plastic antenna adapter is supplied with the flexible CB antenna.

Refer to Figure 7. Slip the plastic antenna adapter over the BNC connector and bend the center conductor wire down along the antenna adapter slot. Slip the flexible antenna base over the antenna adapter and tighten the thumb screw on the antenna base to hold the assembly together. Solder the wire to the solder lug on the base. Finally, use a hot glue gun to hold everything firmly in place.

Now for the antenna modifications. Using a sharp knife, split and remove the entire insulating outer cover of the antenna. Refer to Figure 8. Unsolder the enameled wire from the base of the steel spring. Unwrap 8" of the enameled wire and cut it off. Spread the remaining enameled wire over the full length of the nylon rod and hold it in place with electrical tape. Keep the wire tight. Now carefully unscrew the steel spring six turns. Solder a piece of #22 bare copper wire to the end of the enameled wire and wrap this wire along the threads in the nylon base that was exposed when the spring was unscrewed. Solder the other end to the base of the steel spring. Now it's time to adjust the antenna.

Mount the antenna on the roof of your car, using the mag-mount. This antenna is pretty narrowband, so I'd recommend optimizing it for a 200 kHz spread. In my case, I optimized it for the 28.3–28.5 MHz range. Using an SWR meter, check the SWR at the low, mid, and high end of the frequency range you want. This is the only antenna requiring an SWR meter.

The antenna should still be resonant too low in frequency so you'll see your lowest (though still high) SWR at the low frequency end. Now unsolder the wire at the base of the steel spring and screw the spring in ¼ turn. Resolder the wire (after clipping off the excess) and check the SWR. Keep doing this, using no more than ¼-turn increments until you're able to center up the SWR over the frequency range you're interested in. That is, you should have the lowest SWR at your center frequency and the SWR at the edges of your frequency band should be about the same. In my case, I was able to achieve a 2:1 SWR at 28.3 and 28.5 MHz, and a 1.5:1 VSWR at 28.4 MHz.

Finally, use pieces of ½" and ⅝" heat shrink tubing to cover the entire antenna. I also used a blob of hot glue to seal the top end of the antenna.

This antenna works surprisingly well. I can reliably work all over the U.S. and occasionally even make international contacts. It's tough competing with high power and big antennas when trying to work DX, but occasionally I get lucky.

Cellular Antenna

Why would a ham need a cellular phone? Well, you can reliably make and receive calls no matter where you are. Also, it is necessary for any type of business calling. Cellular phones are pretty impressive performers, and once you have one, you don't know how you ever got along without it. So, how about a cellular antenna for your mag-mount?

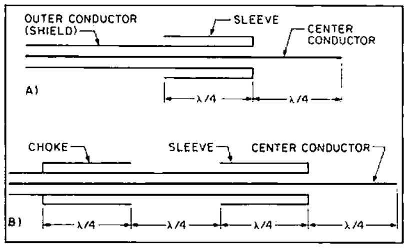

Figure 9. (a) The sleeve antenna, a simple coax-fed ½-wave. (b) Making a choke to keep the rest of the coax feed from being excited.

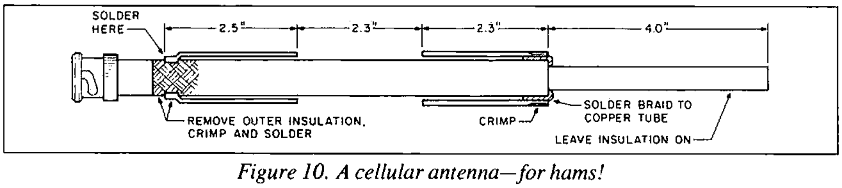

Figure 10. A cellular antenna—for hams!

Mag-Mount Parts List

Cat. #	Qty.	Description
MG-1320	1	Ferrite Magnet
RC-0561	3	Crimp BNC/RG-59
RC-0507	1	BNC-Female Panel Mount
3142-HE	2 ft.	½" Shrink Tubing
3143-HE	2 ft.	⅝" Shrink Tubing

The total for the above was $8.70. MPJ&A has a minimum order of $10. I recommend you buy two extra RG-59 crimp connectors. Marlin P. Jones & Associates, tel. (407) 848-8236.

The cellular frequencies cover 825–845 MHz and 860–895 MHz, approximately. The cellular phones transmit in the low end of the band and receive the cellular base stations transmitting in the upper end of the band. I decided to build a ½-wave antenna for this band.

The sleeve antenna is a simple coax-fed ½-wave antenna. See Figure 9(a). Basically, it's no more than a ¼-wave whip with the image provided by the ¼-wave sleeve folded back over the coax cable. By placing another ¼-wave sleeve a ¼-wave away from the open end of the sleeve, you make an excellent choke that keeps the rest of the coax feed from being excited by the signal and causing pattern degradations. See Figure 9(b).

I designed the antenna for the center of the cellular band (859 MHz). The antenna lengths are calculated as follows:

1/4 wave @ 859 MHz = 2952/859
= 3.5 inches

The velocity factor for RG-8M coax is 0.66, so:

1/4 wave (adjusted) = 0.66 x 3.5 = 2.3 inches

I constructed the antenna as shown in Figure 10. Obtain a one-foot piece of ⅜" diameter copper tubing from your local hardware store and cut 2.3" and 2.5" lengths of this tube. Cut a 12½" length of RG-8M coaxial cable. Remove 4" of the outer insulation from one end. Unbraid the outer conductor braid, trim it to about ½" and fold it back over the remaining outer insulator. Slip the 2.3" long copper tube over the braid as shown, crimp it in place with an F-type TV connector crimping tool, and solder the lip of the tube to the braid.

Now, remove 1.6" of outer insulation from the other end of the RG-8M and slide the 2.5" copper tube over this end till the two copper tubes are separated by 2.3". Crimp the end of the 2.5" long tube over the bare outer shield and solder as shown. Attach an RG-59 crimp-on connector to this end of the cable. Finally, cover the antenna with ½" heat shrink tubing and shrink it to provide a nice looking, rugged cellular antenna. I also sealed the top end of the center conductor and the interface between the center conductor and the sleeve with hot glue.

Cable Comparisons

Freq.	RG-58 loss/100 ft.	RG-8M loss/100 ft.
50 MHz	4.0 dB	2.2 dB
100 MHz	5.3 dB	13.0 dB
200 MHz	8.0 dB	4.6 dB
400 MHz	12.0 dB	7.5 dB

RG-8M, at 25¢ per foot, is only a nickle a foot more than RG-58. RG-8M low-loss, 52-ohm cable is significantly better than RG-58, and it has the same dimensions as RG-59 (so you'll find use for the extra RG-59 crimp BNC connectors). You can obtain RG-8M at Radio Shack, part number 278-1328.

I optimized the SWR for transmitting in the lower portion of the band—that's why the center conductor whip is longer than a ¼-wavelength. With the dimensions shown, I achieved better than a 1.5:1 SWR in the 825–845 MHz end of the band.

Well, there you have it—enjoy your new car-top creations. 73

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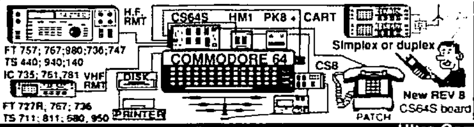

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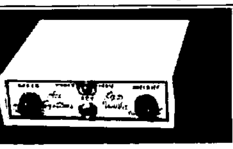

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CIRCLE 38 ON READER SERVICE CARD

Continued from page 40

Fixed and Adjustable Voltage Regulators

LM317T	1.5–37 volts	1.5 amps	40 volts input max.*
7805	5 volts	1.5 amps	35 volts input max.
7812	12 volts	1.5 amps	35 volts input max.
7815	15 volts	1.5 amps	35 volts input max.
7824	24 volts	1.5 amps	40 volts input max.

These regulators can be used over a temperature range of 0 to 70 degrees Celsius.
The current ratings may vary, depending on manufacturer and degree of heat sinking.
Other units available from suppliers cover voltages from 2 to 24 volts.

*Input/output differential voltage limited to 40 volts max. The LM317T is an adjustable voltage regulator that requires a few external parts. See Figure 5.

If you cascade a current regulator and a voltage regulator, the current regulator acts as a very small value of resistance until all the current limit is reached. At values of current under the preset current limit, the voltage regulator simply operates normally. The combination of the two devices makes an excellent all-purpose power source offering the ultimate in flexibility and circuit protection. See Figure 3 for an example of how these two regulators may be cascaded.

Handling Increased Current

This circuit is a natural for the creative experimenter who needs a flexible power source for his experiments. The only thing to remember is that you cannot adjust the voltage to a value lower than the value of the regulator. This limitation, present in many commercially available supplies, is not a serious problem.

In fact, you won't have any serious problems with these regulators as long as you remember to properly heat-sink them. I have seen these units paralleled in an effort to increase current capacity, but I don't recommend it. If they have a small resistor in series with the output of each unit, you can parallel them, but voltage regulation worsens, even though power is divided more equally. A much better way to handle the problem of increased current is shown in Figure 4. Use a series pass transistor in conjunction with the three-terminal regulator.

Try a few experiments with these devices, and when you design them into your circuits, they will give your projects that little edge.

Ed Doubek N9RF, P.E., may be reached at 25 W. 062 Wood Ct., Naperville IL 60563.

CIRCUITS

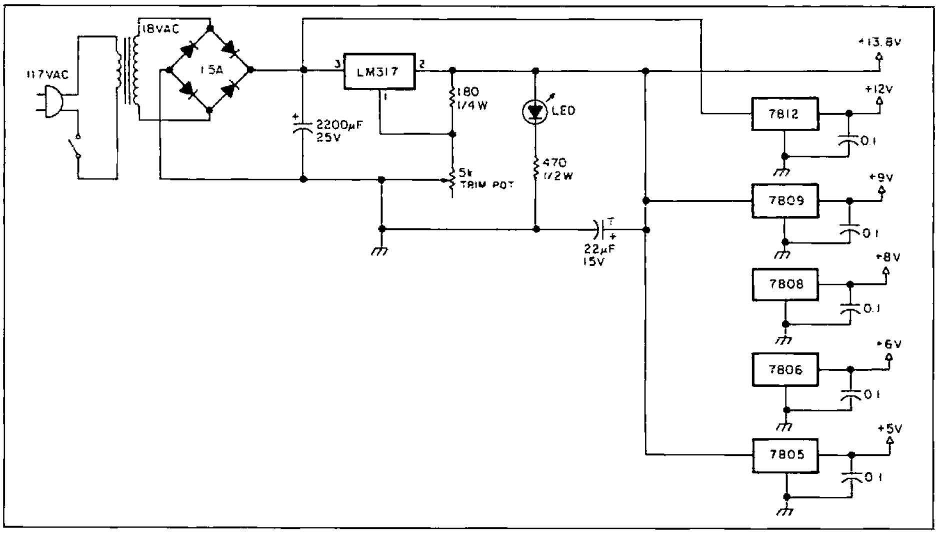
Number 15 on your Feedback card

Great Ideas From Our Readers

Regulated Voltage Distribution Box

Not only do most hams have numerous gadgets which devour 9 volt batteries, they also have pocket radios, TV sets and table radios that use batteries. The most common voltages needed are: 4.5, 6, 7.5, 9 and 12 volts. Battery types needed include AAA, AA, C, D and 9 volt types. Batteries can be expensive, and often the size that you need is not on hand when you want it.

The gadget shown in Figure 1 solves this problem for all time. Any small transformer with a secondary of 18 to 24 volts AC at an ampere or more, a 1.5 ampere bridge, a few thousand microfarads of filter capacity, and an LM317 variable voltage regulator, forms the heart of this unit. The LM317 is set to provide +13.8 VDC output. Fixed regulators of 12, 9, 8, 6 and 5 volts provide the remaining output voltages. Output of the LM317 is bypassed by a 22 µF 15V tantalum capacitor, which will also bypass the inputs to all fixed regulators except the 7812, which is fed from the input of the LM317. All fixed regulators have their outputs bypassed by 0.01 µF monolithic capacitors. All outputs are self-protected and will deliver up to one ampere.



Although the LM317 and most fixed regulators are readily available from Radio Shack and most mail order sources, the 9 volt regulator (7809) is available only from *Short Circuits, P.O. Box 285, Barnegat NJ 08005.* They are sold four for $1. LM317T regulators from the same source cost 35¢ each. Type 7805, 7808 and 7812 regulators from Short Circuits are also four for $1. They have other fixed and variable regulators at similar prices, but do not carry the 7806 at this writing.

Use 5 volts for 4.5 volt equipment, and 8 volts for 7.5 volt gear. The slight voltage differential will not cause any harm. However, the 9 volt output will probably see the most service in the shack!

J. Frank Brumbaugh KB4ZGC
Buffalo NY

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Finishing Up and Moving On

At last we're ready to wrap our ongoing topic up! So, let's finish our stage-by-stage troubleshooting now.

Mike amps: These amplify the mike's signal enough to drive the modulator. In FM rigs, they often will contain compressors, in order to keep the modulation from deviating outside the legal ±5 kHz bandwidth. (In SSB rigs, of course, the ALC feedback from the finals can prevent overmodulation.) FM amps may also incorporate lowpass filters, especially if the rig is to be phase-modulated (see below).

The usual problem with a mike amp is that it is dead altogether. Occasionally, one may work but be weak. These amps typically are ICs in walkies, but may be transistors in HF rigs. Troubleshoot as with any low-level amp, looking for a loss of signal at the output and working back until it appears. By the way, a common cause of mike amp failure in HF rigs is severe RF feedback. The voltages induced by the transmitter into the amp can be enough to blow the semiconductors. If you've had a feedback problem and then suddenly lose your audio, check the mike amp first! You could save hours of troubleshooting frustration later.

RF feedback itself is not a mike amp problem. It is usually caused by a poor station ground or by having the antenna too close to the rig. It may also occur when a mismatched or preamplified mike is used. If you're getting bad distortion or squealing on transmit, try running into a dummy load. What, you don't have one? No comment. But try reducing your output power as much as possible. If the trouble goes away, your mike amp is fine. (By the way, the RF power or drive control on many rigs, especially the tube-output kind, affects only CW and AM. Often, the only gain control in SSB is the mike gain pot! Try turning it down until the power output meter barely moves.)

Modulators: These are much like the mixers we explored in previous columns. They have two inputs and one output. One input, of course, is the audio to be modulated. The other is the carrier. In AM and SSB, the modulator is likely to be a ring of diodes, just like a balanced mixer. When the circuit is perfectly balanced, DSB is generated. (Subsequently, one sideband is clipped off by the sideband filter to make SSB.) For AM, the ring is deliberately unbalanced to allow the carrier through.

FM is another story. Modulation is accomplished by swinging the carrier's frequency back and forth in step with the audio signal. In one scheme, a carrier oscillator is varied directly, through the use of a varactor diode. This can result in very high-quality FM, but it is hard to do, because the oscillators are nearly always crystal-controlled, and therefore hard to swing enough for decent modulation. In synthesized rigs, which most are nowadays, it is possible to insert the audio into the VCO's control loop. As long as the PLL's loop filter is fairly slow, it will not notice the audio and will not try to correct for it. Thus, the VCO will wiggle back and forth in frequency. Voila, FM. In this case, the modulator may be no more than a transistor in a basic amplifier configuration.

Another popular FM scheme is phase modulation. It's especially common in rigs which multiply an oscillator's frequency several times to get to the actual operating frequency or to something high enough to heterodyne against another oscillator. Phase modulation is simple. You take a fixed oscillator and feed its output into a tank circuit comprised of a coil and capacitor in parallel. The cap, however, is a varactor diode. When audio is applied to the varactor, the changes in its capacitance will cause the tank circuit to shift the phase of the oscillator's signal back and forth. The only difference between phase and frequency shift is that the former occurs within one cycle. In other words, it is just smaller. When the signal is multiplied way up to the operating frequency, the shift is also multiplied, so it appears as if full frequency modulation has occurred. The drawback to this simple technique is that the modulation is nonlinear. For a given amplitude (level) of modulating audio, as its frequency rises, the rate of modulation (amount of frequency swing) also rises! Left alone, this would result in very tinny-sounding, ugly audio at the receiver. The cure is to insert a lowpass filter in the mike amp which reduces the amplitude of the audio as its frequency rises, thus exactly counterbalancing the modulator's rising effect. In practice, the two never exactly track, so phase modulation doesn't produce the quality of true FM. Nonetheless, it is a widely used technique because it is cheap and easy to do. Besides, the audio is good enough for communications use, which is never intended to be hi-fi anyway.

A CW modulator is basically a switch, usually made from a transistor. In order to make nice, clickless keying, though, it usually incorporates some capacitors and diodes, or other nonlinear time constants, so that it can turn on and off gently and at slightly different rates. That way, the carrier doesn't come on and off abruptly. A few milliseconds on each end is typical. If you can't key the rig, and the key or keyer is working and properly connected, the keying transistor is probably open. If the rig stays keyed all the time, it is probably shorted. If it keys and then locks up, check for RF feedback the same way as for a mike amp. Usually, that's the problem in this situation.

Some keying circuits can get surprisingly complex, with several transistors and perhaps some ICs. This is because some rigs require sequencing of various stages in order to avoid injuring their own circuits. For instance, the antenna may need to be disconnected from the receiver before the transmitter comes on. In any event, look for large shifts of voltage (a few volts or more) between the keyed and unkeyed states in each stage. If the shift disappears or becomes very small, you're near the trouble.

By the way, all of this applies only to all-solid-state rigs. If yours has tube driver and finals, the keying circuit can be quite different, and may involve dangerous high voltages.

Carrier oscillators: These are just local oscillators, exactly like the kind used in receivers. They may be crystal-controlled or be driven by the synthesizer. The distinguishing characteristic is that the frequency will be a few kHz different for USB than it is for LSB. The idea is to use the same SSB filter for both modes, and to approach it from either end of its passband. Oscillator crystals are a heck of a lot cheaper than SSB filters! If you suspect the oscillator is not working, try changing modes.

If it works on one sideband but not the other, suspect the defective one's crystal or its associated trimmer capacitor. If the oscillator is dead on both sidebands, the active element (transistor, FET, etc.) is the most likely culprit.

ALC circuits: These are much like receivers' AGC circuits, except that the input is a sample of the transmitter's RF output, and the circuit controls the power going into the finals. If your ALC meter doesn't work, and your transmitter puts out full power but overdrives, check here first. Most likely, you'll find an open transistor or RF sampling diode. If your transmitter is weak or close to dead, be sure it isn't being clamped off by a shorted ALC transistor before you spend big bucks for new finals.

RF power amps: This is tricky. Solid-state finals operate with high current, as much as 20 amps for a 100-watt rig. Circuit inductances can transform some of this into fairly high voltages (up to 200 or more volts) and that can be dangerous to work with, especially because the frequencies are RF. DON'T assume that, just because the radio runs on 12 volts, it is safe no matter where you stick your finger. You may be in for a nasty surprise.

The usual symptom of RF power amp trouble is very low or no output in transmit. People tend to blame the finals the way they used to blame the picture tube in a dead TV- it's dead so it must be the finals. Although replacing finals is very easy, it is also expensive. A pair of RF output transistors may cost you $80 or more. So, be absolutely sure you need them before you waste your money. Is RF getting to their inputs? Is the driver stage working? Often, the driver will go but the finals will be OK.

Or the finals will go and take the driver with them! Test all the transistors before you chuck them. By the way, low output, say 60 percent, is most likely not caused by bad finals. They are not like tubes—they don't weaken with age. I have seen leaky transistors reduce output, but it is rare and other symptoms, like severe distortion, should also be present.

OK, so the finals are indeed bad and you want to replace them. Before you do, ask yourself: What blew them? They rarely go by themselves. If you know why they went (shorted antenna coax, etc.), great. If not, check everything you can to be sure you won't blow the new ones. Nearly all solid-state rigs have some kind of SWR protection circuit, consisting of a reverse power detector near the transmitter output and a signal amplifier which limits the power going into the finals when the SWR goes above a preset limit. It's kind of like a receiver's AGC circuit, except that its input is from reverse power caused by high SWR. Check the detector diode and the amplifier transistors, especially if you suspect that high SWR killed your finals.

In HF rigs, changing the finals is easy. Buy a new pair, either from the radio's manufacturer or from a parts house. Always buy HF finals in pairs, even if one of yours looks OK. If their characteristics are not fairly well matched, they may not work well together, and may fail prematurely. Besides, if one failed, the other may be subtly damaged and getting ready to go. If it does, it may ruin your new one anyway. Install the new parts as you would any power transistors, and don't forget the thermal heat sink goo—it's an absolute must, except in cases where dry-type insulators are used. To be sure, just look at the originals. HF power amps are usually wideband, and don't require any trimmer adjustments. Most likely, you'll have to set the base bias. Consult the rig's service manual for the proper procedure. Failure to set the bias will probably result in poor operation and short-lived transistors.

In VHF and UHF rigs, the situation is quite different. First, there is usually just one final or a large power IC. Also, these amplifiers are tuned to operate over the band of interest, and replacement of the discrete variety requires adjusting various trimcaps and perhaps a few coils. The rig's service manual should detail the procedure, but you may find that it requires expensive equipment to do it right. The IC variety, however, is usually easy to change, and generally has few or no adjustments surrounding it.

Well, I think we've finally wrapped this mini-series up. Next month, something completely different! See you then. ■

Number 17 on your Feedback card

NEW PRODUCTS

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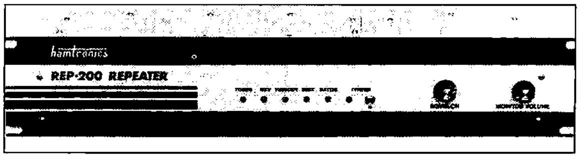
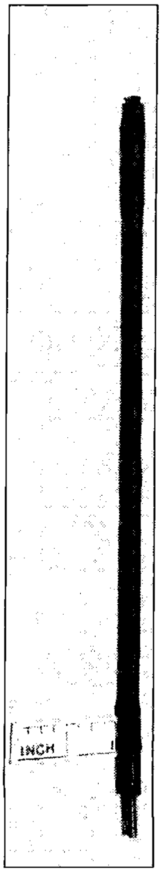


PRODUCT OF THE MONTH

HAMTRONICS, INC.
REP-200 Repeater

The microprocessor-controlled REP-200 Repeater is a successor to the popular REP-100 Repeater. It provides autopatch, two types of reverse autopatch, six types of courtesy beep, and a DTMF decoder/controller with over 50 functions. Until now, the REP-200 was available only wired and tested because of the complexity of building and testing the controller module. Now Hamtronics has made it available in kit form, with the COR-5 controller module prewired, programmed, and tested, for only $1095.

All of the repeaters are available for the 2 meter, 220 MHz, 440 MHz, and 902 MHz ham bands. (The 902 MHz version costs a little more.) For more information, call or write for a free 40-page catalog, and ask for the "supplement for repeater kits." Contact *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535; (716) 392-9430, FAX (716) 392-9420.* Or Circle Reader Service No. 201.



STATIC BUSTERS INC.

Static Busters Inc. has introduced their new Precipitation/Corona static device: the AS-1, a static discharge wick. The AS-1 will provide a path for electrons or static charge dissipation on towers and antennas of all types, and will reduce significantly or eliminate corona noise and precipitation static. During p-static or corona charging conditions the discharger can improve the noise level up to 20–30 dB or more, depending on the frequency.

The discharger (AS-1) is priced at $12.95 (plus $1 shipping & handling). Contact *Static Busters Inc., 3535 Sheperdsville Rd., Elizabethtown KY 42701; (502) 769-2244.* Or circle Reader Service No. 202.

STARTEK INTERNATIONAL INC.

The Model AP-90 Amplifier-Prescaler from Startek International Inc. can extend the range of any frequency counter capable of measuring to 16 MHz or higher, to 1600 MHz or 1.6 GHz. Two MMIC amplifier stages produce a superb sensitivity threshold of typically 1–5 mV RMS. The AP-90 also provides a 10-segment LED bar graph indicating the relative strength of the input signal. There are two overlapping ranges, 10 to 500 MHz/divide-by-10 and 300 to 1600 MHz/divide-by-100.

A special panel mount version, Model AP-90-H, is available as a custom plug-in accessory for the Hewlett-Packard 5245L/M, 5246L and 5248L/M counters. The AP-90-H has two-stage amplification of the input signal (rendering superb sensitivity over the entire operating range), a switch-selectable prescaler, divide-by-10 or divide-by-100, and an RF signal strength LED bar graph.

The Model AP-90 (including AC adaptor) is priced at $160; the AP-90-H is $180. When purchased from the factory or an authorized distributor, the AP-90-H has a one-year limited warranty to the original purchaser covering parts and labor if the unit should fail after proper usage.

Startek International also makes 1500 MHz hand-held frequency counters, prices starting at $100. Contact *Startek International Inc., 398 NE 38th St., Ft. Lauderdale FL 33334; (305) 561-2211, (800) 638-8050, FAX (305) 561-9133.* Or circle Reader Service No. 204.

JENSEN TOOLS INC.

The new 1991 *Master Catalog* from Jensen Tools is a complete source of tools, tool kits and test instruments for service and repair of electrical and electronic devices. This 232-page catalog features 11 pages of unique new tools and accessories for bench and field service, including new ergonomic tools, soldering/desoldering stations, a solderless terminal kit, circuit testers, probes, new products for static control, cleaning accessories, and more.

To order this free catalog, contact *Jensen Tools Inc., 7815 S. 46th St., Phoenix AZ 85044; (602) 968-6231, FAX (800) 366-9662.* Or circle Reader Service No. 203.

ELECTROSOFT

Electrosoft has introduced a CW keyboard program and interface kit for IBM-compatible computers having a serial port running on MS-DOS. The program and kit provide a convenient alternative to using a keyer if a computer is already in the ham shack. CW operators will be pleasantly surprised how the quality of code and ease of operation exceeds that of any keyer.

The program was designed using assembly language, resulting in an impressive, snappy response to each command. Operators will breeze through their first QSO because a HELP key displays all commands on the screen instantly any time help is needed. The speed may be adjusted from five to 100 words per minute, and the dot/dash ratio from 21% to 45%. Messages may be temporarily stored in any one of 10 200-character buffers, or may be permanently stored on disk. A REPEAT function will repeat CQs or beacon messages indefinitely. Contesters will enjoy the automatic serial number that can be incremented or decremented and inserted into a message. A CW sidetone may be turned off or on as needed. The interface kit is easy to build even for novices, and it usually requires about one hour to complete.

The program and interface kit is $50; the program alone is $25. For more information contact *Electrosoft, P.O. Box 1462, Loveland CO 80539.* Or circle Reader Service No. 205.

ZCo Corporation

73 gets lots of requests for information on Macintosh software for hams. ZCo Corporation is one source. Their catalog offers 11 programs for ham radio operators. This selection includes programs for theory and code training, mapping, logging, satellite tracking, and contesting.

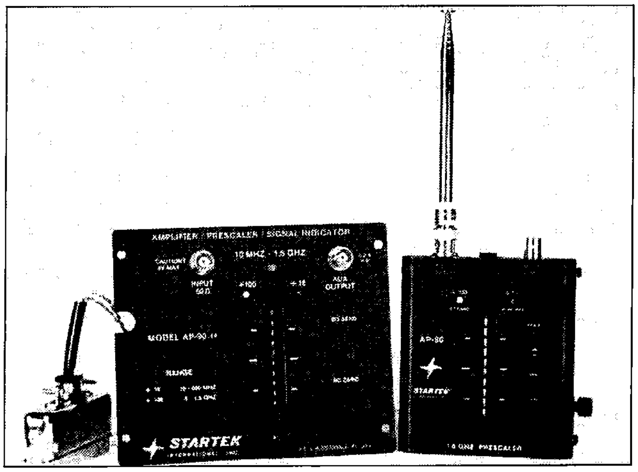
For a copy of the catalog contact *ZCo Corporation, P.O. Box 3720, Nashua NH 03061; (603) 888-7200, FAX (603) 888-8452.* Or circle Reader Service No. 206.

INTERFLEX

Packet GOLD 1.2, a new software terminal program for the PK-88 and PK-232 controllers from InterFlex Systems, makes multiple connects easy. It uses a "next session" queuing system to take you to the next session with incoming text. With its continuous monitoring feature, you'll know what's happening on the channel at all times. Many functions provide additional support for multiple connects, including text search, cut/paste facility and connected station list.

Binary file transfers can be initiated at either the source or the receiving station. An integrated setup facility lets you customize the program to your needs. Put in "Quick-Connects" for point-and-shoot selection of frequently called stations. An integrated text editor allows you to edit text cut from any screen, or while editing a file.

This program is available for $60 (CA residents add 6.25%) from *InterFlex Systems Design Corporation, P.O. Box 6418, Laguna Niguel CA 92607-6418; (714) 496-6639.* Or circle Reader Service No. 207.



Number 18 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

RTTY Loop XIV:7

Over the 14 years this column has run, the one single question I have received more often, time and time again, is a version of, "Did you cover this before, and if so, when?" So, from time to time, I have offered an index of past columns to help with locating topics covered. Several of you have suggested that I take the time to publish just this index, suitably updated, to help all of our readers. I herewith humbly comply.

This is a complete index to "RTTY Loop" from the beginning, organized by month and year. Now you know where to find the material that you're looking for. Getting copies of these articles will be up to you. I used to provide copies for a nominal fee, but the pressures of my job and family have cut into the time required for that. If you need reprints, contact *73 Amateur Radio Today*, WGE Center, Forest Road, Hancock NH 03449. Enclose a check for $3.00 for the first copy of an article and $1.50 for each additional copy.

Next month, we'll look at what some of you have been saying! As always, I look forward to your comments, suggestions, and criticism. Just pen a line to me at the above address, or e-mail it to me on CompuServe at 75036,2501, or on Delphi via MARCWA3AJR. Any way you send it, I look forward to reading your thoughts about "RTTY Loop"! 73

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Dx

Number 19 on your Feedback card

Hams Around the World

Bob Winn W5KNE
%QRZ DX
PO Box 832205
Richardson TX 75083

S. Georgia and the S. Sandwich Islands

In October we were very disappointed to learn that the DXpedition to South Georgia and the South Sandwich Islands had been postponed. Tony WA4JQS, organizer of the DXpedition, told me that the DXpedition had been postponed, not cancelled. With the Middle East crisis causing an increase in fuel prices, Tony explained, the shipping company had to put a hold on shipping traffic in the Antarctic area. The fuel expense alone for the DXpedition charter had increased by more than $40,000.

Equipment and supplies will be stored until the DXpedition becomes reality. All expenditures have been paid by the team members themselves, and all donations are safe in a bank account. Tony also noted that other possibilities are being investigated. The South Sandwich Islands remain on the inactive list, but there is at least one station currently active from South Georgia Island. Gordon VP8CDJ has been active since late last year, but he leans towards DX nets and does not operate CW. Gordon's QSL manager is GM4KLO.

Wanted: Adventurer, Sailor, CW Op

In June of 1991, Doug VE7NH intends to leave VE7 aboard his 30-foot sailboat for an island-hopping journey across the Pacific, stopping at some of the more rare DX spots. If permission is obtained, he'll operate from each. His list of DX stops includes Palmyra Island, Kingman Reef, Rotuma, Christmas Island, Mellish Reef, Willis Island, Norfolk Island, Kermadec Island, and Campbell Island.

Doug is looking for a sailing companion competent with CW who is willing to share costs and help sail the boat. The sailing companion need only participate in part of the trip. Contact Doug at the following address: Doug Brabner, 1429 Williams Ave., North Vancouver, BC V7L 4G1, Canada (or on 14025, 18071, 21025, 24900 or 28025 kHz). All inquiries will be answered.

Thailand

According to John K9EL who travels to Thailand several times each year, it is not true that any visiting ham can operate a RAST (Radio Society of Thailand) club station. If you are planning to visit Thailand, John suggests that you write to Sombat HS1BV at his *Callbook* address well before the visit. Prior arrangements must be made, and operating permission is not guaranteed. HF operation in Thailand is on a temporary basis, and is subject to change at any time.

Other active stations in Thailand include HSØAC (was HSØSM) at the Science Museum in Bangkok; HSØB, RAST club station in Bangkok; HSØAIT (was HSØA) located at a university about an hour's drive from Bangkok. QSLing to the HS bureau is not reliable. QSLs for Thai stations should be sent to the published QSL manager or as directed by the operator. Individual operators of club stations can often manage only their own QSOs. Confirmations of HSØAIT contacts is difficult at this time.

John has attempted a lot of 80 and 40 meter activity from Thailand, but he reports that the noise in Bangkok is just unbelievable. Commercial stations operate at will, and there is significant interference from nearby TV, radio and military transmitters. There is also significant interference from nearby countries where the amateur radio bands are not protected. John passes along his thanks to everyone who has sent contributions with their HSØE QSL requests. These donations help to improve the station equipment at HSØE.

QSL Notes

9M2AX, 9M8AX and 9M8XX. JA5DQH was the QSL manager for these stations, but he is currently active as HI8A and will be in the Dominican Republic for one to two years. Ross 9M2AX asks that all QSLs for these stations be sent to him: Ross E. Tanaka, F7, Menara Impian, TMN TAR 60000 Ampang, Kuala Lumpur, Malaysia.

SMØKCR is the QSL manager for LU2BC, 7S8AAA, SMØOIG/YN, SMØOIG/LU, HT3A, H71A, SMØMT and SKØUX has a new address: PO Box 1441, S-18314 Taby, Sweden.

CIØGI Grosse-Ile. The ARRL's DX Advisory Committee (DXAC) has voted not to recommend that Grosse-Ile become a separate DXCC country. The vote was unanimous. The ARRL Awards Committee makes the final decision about DXCC country matters and is expected to echo the no-vote. The island, located in the St. Lawrence River near Quebec, was activated during late July 1990 by a group of operators from Quebec. 73

QSL Routes

3C1EA	via EA4CJA
3D2JH	via KF7PG
4KØADS	via RW3AH
4X6TT/5B4	via 5B4SA
5Z4DU	via KE4DA
6W1QB	via DK3NP
7J1ADJ/JD1	via KB1BE
9H1FBS	via N5APW
9H3KE	via PAØPAN
9M2AX	via 9M2AX (see QSL Notes)
9M8AX	via 9M2AX (see QSL Notes)
9M8MKS	via 9M2FH
9M8XX	via 9M2AX (see QSL notes)
A41JV	via KJ4GK
C53GS	Box 274, Serekunda, Gambia
CN2BB	via DF4VS
CS9M	(CT3) via DL9XY
CT3FF	via IØWDX
CWØW	via CX4CR
DA1MF	direct only: Mark Foster HHD 32d AADCOM, CMR 525 APO NY, NY 09175 USA After Dec. 1, QSL to his home call, NW4Y
DJ9RY/CT3	via DJ9RY
FT5XA	via F6ITD
HBØ/HB9NL	via HB9NL
HFØPOL	via KB6GWX
HKØAZW	Box 120, San Andres, Colombia
ISØYUJ/IMØ	via ISØYUJ
IZ8SGV	via IK8IPL
K1EFI/VP9	via K1EFI
L3D	via LU6DTS
ORØOST	via ON6BY
P7U (?)	Kim, Box 17, Pyongyang, North Korea
PJ7RR	P.O. Box 431, St. Maarten, Dutch West Indies
PJ8MM	via K1MM
PQ5C	via PY5CC
R6L	via UZ6LWZ
RHØE	via UH8EA
RH3W/RA4CG	via RA4CG, Box 3, Rtishchevo 412010, U.S.S.R.
RQ9W	via UQ1GWW
RY8B	via RB5AA's *Callbook* address
SØ1A	via EA2JD
SMØKCR	Has a new address (see QSL Notes)
TJ1BD	Box 1185, Douala, Cameroon
TR8JL	via F6IXI
TV1L	via F1LBL
UH1W/UA4CIC	same as RH3W/RA4CG
V51P	Box 9080, Windhoek, Namibia
V51SW	via G1IOV
VE1MQ (NA-68)	via VE1BTT (his previous call)
VP2EBN	via KA3DBN
VP8CDJ	via GM4KLO
YJ8AB	via KC4MJ
YZ9ØS	via YU2AKL
ZD7VC	via WT8S 1990 *Callbook* address
ZD8PJ	Box 3, Ascension Island
ZL15ØA	CW via ZL1AMO; SSB via ZL1AAS

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World Class Hiding

Transmitter hiding can provide as many surprises as transmitter hunting. Most of the time the surprises add to the fun. Last month I presented construction plans for the Fox Commander, which remotely controls the audio and on/off timing of your hidden transmitter. The only things left to add on that topic are a few general precautions to help avoid some not-so-pleasant surprises.

Smart hidden transmitter operators take no chances—they **check out the setup well ahead of time and take back-up gear** if they have any. There is nothing worse than being out in the boonies and discovering five minutes before the hunt is to start that the gear won't work.

At least one day before the hunt, set up your remote-controlled hidden T system in your back yard and give it a thorough run-through to discover any incompatibility between the various pieces of gear. Does the third harmonic of the 2 meter hidden T fall close to the 70cm remote control frequency? If so, your remote control range may be very small. Check it.

What about interference from the high-power hidden transmitter to sensitive CMOS circuitry in the tone box? This problem can be particularly bad on 10 and 6 meter hunts, but it could happen on any band. The usual RFI suppression techniques (chokes and capacitors) will cure the problem, but it's vital to find out well before hunt time.

Is the supply current drain what you expected? Check to see what happens as your big 12-volt battery discharges down to less than 11 volts. Does everything keep running, with just a reduction in RF output power, or does some item of gear "lose its brains"?

Murphy Lurks

Even if you are convinced that you have found the perfect hiding place, one which will foil the hunters and "spread 'em out," you'll probably have nagging doubts. What if they all get exactly the same bearing, take the same route, and arrive at the same time? What if conditions change and they can't hear the signal at the start point? What if someone put up a new fence or gate and you can't get back to that great hiding spot you found last weekend? Murphy loves foxhunting because he can foul things up for hunters and hiders alike.

Two years ago, WA6OPS and I put on an 8 p.m. hunt that was sure to be an "all-nighter," even though we were only 11 miles from the start point. To get to the spot, you had to find a dirt-and-gravel path that went along a railroad track for about a mile and a half, then up over a hill and down into a canyon on a fire access road.

The only vehicle entrance to the railroad path was next to a bridge, with a steep drop-off that made the turnoff nearly impossible to see at night. Other roads led up to the railroad tracks, but they were closed with high construction fences.

Just 45 minutes after the start, a set of headlights topped the hill, and we were found, followed soon by the rest of the teams. Curses! The construction workers had opened up the fence in the intervening week since we discovered the spot. Moral: **Recheck the area of your site just before hunt time.**

Watch out for propagation changes. About a year ago, WA6TQY hid a 2 meter flea-powered rig on a hillside in Rancho Palos Verdes, carefully positioned to be shielded from the Diamond Bar starting point. Just as expected, the initial signal was very weak, and propagated by reflections from the mountains to the north of the start point. Many hunters took off toward the mountains, just as a bank of low clouds began to come in from the ocean.

As this marine layer blanketed the start point, the few teams remaining noticed a big change as they rotated their beams and quads. In addition to the weak signal from the mountains, there was now also a much stronger signal from the southwest. Those that followed the southwest signal went straight to Palos Verdes, where they found the fox.

It took the marine layer to propagate the signal over the intervening hills in a direct path. WA6TQY's skulduggery was the victim of a change in the weather, and the teams that spent a few extra minutes plotting their bearings got a lucky break.

Hunts to Remember

Everyone has his own idea of what constitutes the ultimate hunting challenge. To some, it's long distance. Any 2 meter hunt over 200 miles, such as the Los Angeles area hunts that have ended in Arizona or Nevada, surely must be world class.

To others, there has to be more than one transmitter to hunt. RDF enthusiasts from the Phoenix area brag how they can bag four, five, or more foxes in a single evening.

A combination of long distance and multiple T's certainly could be world class. Last September, AF6O and N6MI scattered four transmitters in the Mojave Desert. The first was 56 air miles north of the start point. Each successive fox was about 35 air miles farther east. The shortest road mileages between them were much greater, of course, and there were plenty of signalreflections from the

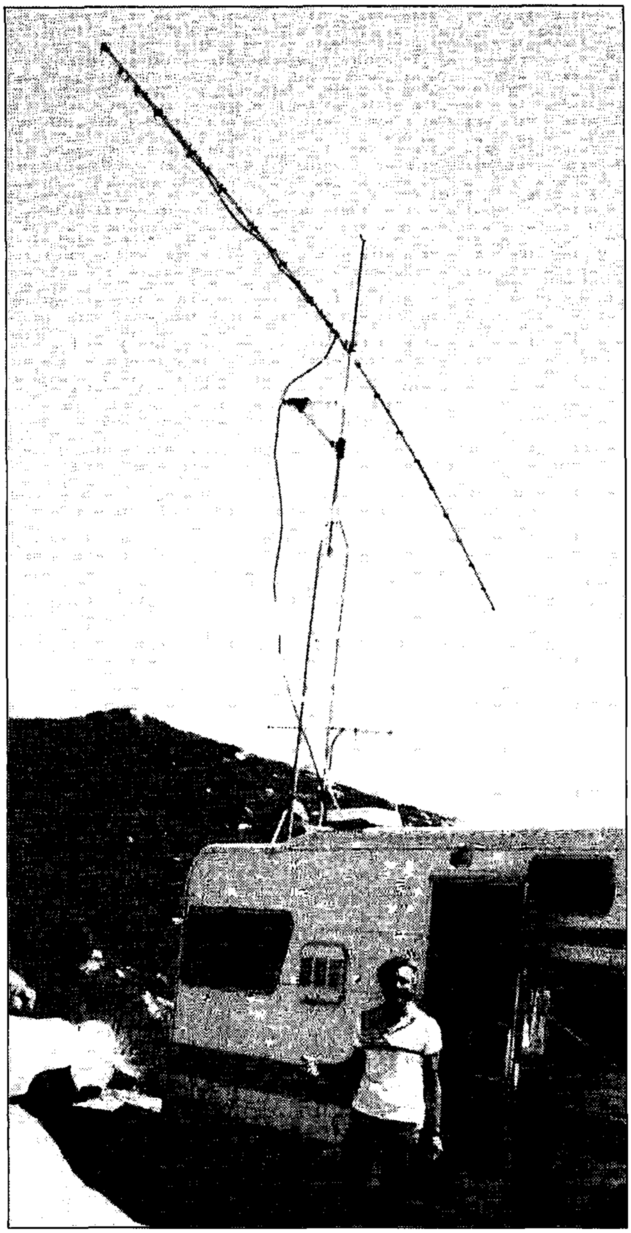

Photo A. Tom Wilson AJ6L can smile because his hard work in setting up this hidden station paid off in a successful T-hunt at the 1990 ARRL Southwest Division convention.

Photo B. Teresa Ashley N6UZH and her mother, Jo KB6NMK, are overjoyed moments after finishing "in the money" in a world class mobile hunt.

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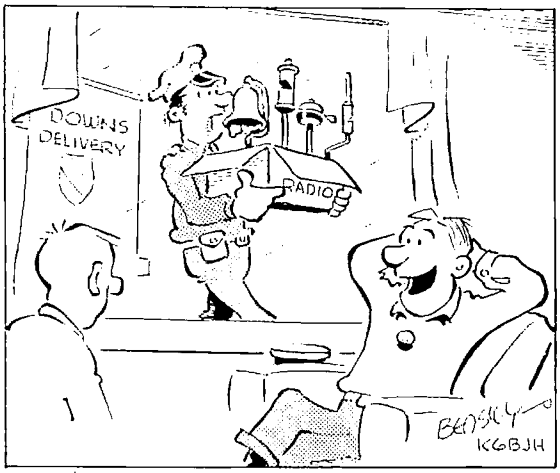


I CAN'T WAIT TO GET MY NEW RADIO --- I TOLD THEM I WANTED ALL THE BELLS AND WHISTLES ON IT

surrounding mountains.

Only four of the 10 starting teams found all four transmitters. Winners Deryl Crawford N6AIN and Tom Ritchie N6FBH put 383 miles on the odometer and took almost 16 hours to complete the hunt. The highest mileage among those who found all four was over 660 miles! You will know you have put on a great hunt when the hunters keep talking about it on the local repealer for days.

The annual ARRL Southwest Division convention almost always includes a world class transmitter hunt to close the festivities on Sunday afternoon, usually with some valuable prizes. The convention T-hunt committee has a tough job. The hunt must be a challenge to experienced hunters, but not intimidating to newcomers. It must not appear to give unfair advantage to locals, who have hunted frequently near the convention site.

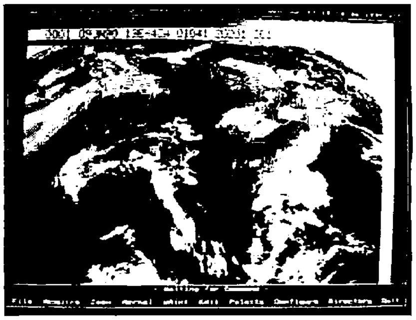
Tom Wilson AJ6L went to a lot of effort to put on the T-hunt for the 1990 Southwest Division gathering in San Diego last August. Tom hid at the end of a four-mile-long dead-end road down a creek emptying into San Vicente Lake. The end point overlooking the lake was well-shielded from the start point, but it was line-of-sight to the Silverwood and Mil Pedra Wildlife Sanctuaries and a nearby Indian reservation.

To make sure he splattered signal all over those places, and to be audible at the start, Tom needed a "killer" setup. He used a 20-element yagi on a crank-up tower, fed by hardline from a 500-watt amplifier using a pair of 4CX250 tubes (Photo A). Power for this setup came from a generator on the side of the embankment. Even with all this, it took a beam or quad to hear the signal at the beginning.

Eighteen cars, trucks, and vans competed for cash prizes in this event. Teams that did this hunt right never left pavement, bul those that went to the sanctuaries or reservation were in for a long, dusty afternoon of dirt-roading. The super-strong signals there made them think they were very close, even though Tom was actually over two miles across the lake by air, and over 20 miles by road.

Jerry Gastil K6DYD from San Diego drove the winning vehicle, assisted by N6WKT, N6WKS and WB6DTA. The mother-daughter team of Teresa Ashley N6UZH and Jo Ashley KB6NMK from the Escondido area hunt group came in second (Photo B). Time was the only factor in determining the winner.

Planning Is already under way to provide an unforgettable hunting challenge for the 1992 ARRL National Convention at the Marriott Hotel near Los Angeles International Airport. The Fullerton Radio Club is in charge of T-hunts for this convention, and welcomes your ideas. Send your thoughts to me and I'll forward them. Also, I would love to hear about your hiding experiences, whether world class or not. I'll share the best ones in this column. 73



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The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Donna DiRusso, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

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Continued from page 4
ters to retrieve a dropped antenna . . . then running out of water on a desert island.

Then there was the morning I worked W7IMW/C7 in Tiensin, China, who was coming in S1 running 10 watts AM to a long wire on 20m. Wow! Or the night I worked all states on 75m. Or the weekend I worked 100 countries on 20m SSB. Or operating JY1 from the palace in Amman.

It was amateur radio that got me into the Navy as an electronic technician and paved the way for me to almost get killed a dozen times in a submarine. You sure learn about yourself when depth charges are dropping all around and you're not at all sure you're going to get out of this one.

Would an affair with a gorgeous Tech (a YL, thank you) count as a ham expenence? That's one chapter in my memoirs you won't want to miss! Heh. I wouldn't trade a top listing on the Honor Roll for that one.

So let's see what you can come up with. Who knows, if I get enough interesting stories I might be able to publish 'em all in a book. How'd you like to have your story in a book?

Yes, double-space it. We'll clean up the grammer and speling. Please don't use those torn spiral-bound notebook pages you usually send in, okay?

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted

High Tech Council

The New Hampshire High Tech Council, which I joined several years ago, is now interested in my project to get all New Hampshire schools to include an eight year course, grades 5–12, on the fundamentals of electronics, communications and computers. I suggested this some time ago, but it wasn't until the current economic downturn in New Hampshire that the timing seemed right.

The whole Boston and southern New Hampshire area bet far too heavily on minicomputers. It isn't as if I hadn't warned 'em that microcomputers would eventually clobber minis . . . and then mainframes. Well, they're doing it now and the result is that Data General, DEC, Prime and Wang are on the skids, with no real hope for long term survival. Alas, these huge employers are passing along their inability to cope with progress to the nearby communities.

I remember trying to convince the president of Centronics, in Hudson, New Hampshire, then the largest manufacturer of printers, that micros called for a whole new generation of printers. He scoffed. Now his plant is making pancake turners and the Japanese are making our printers.

Will we be able to convince the governor that a technically educated work force is the best answer for the future of New Hampshire? We're going to try.

The fallout for amateur radio will be, I estimate, at least 2,000 new amateurs a year, just from New Hampshire alone. We have about 20,000 youngsters in each grade, so if we can get this course into the schools, complete with ham, computer, science fair and other such clubs, I think we can get at least 10% of the kids sold on hamming. I'll let you know how we do with this.

It'll take several years for the project to produce a work force large enough to attract new high tech businesses to New Hampshire. In the interim I have a sneaky plan for a radio/computer project which could get the state back on even keel within a year or two.

If they do get my education project going, New Hampshire is going to be needing a technical university. I'd like to have RPI help develop this since I'm involved with the school. I talked with the president recently and he's game. This could be a perfect opportunity to start a new no tuition engineering university. Let's see, if we can start fifth graders now they'll be entering college in 1999. This could provide New Hampshire with technicians by 1999, engineers in 2002 and scientists in 2004.

ARRL Bashing?

Did you ever try to talk with a drug addict? If you have any friends who are alcoholics, you know that they protect themselves from reality by denial until the situation is beyond being ridiculous. This is the way drugs work, including cigarettes, cocaine, crack, gambling, and so on. Denial.

My recent prescription for saving amateur radio via getting the ARRL to do what needs to be done has resulted in a few ARRL-holics accusing me of bashing the League. Let's put this into perspective.

I'm not "against" the ARRL, any more than a doctor is against a person when that doctor diagnoses a case of cancer and recommends an operation. Diagnosis isn't criticism. As a doctor of entrepreneurial science, I'm in a unique position to diagnose the situation and prescribe what needs to be changed for the health of the League.

So cut out the "bashing" baloney, notice that you're into denial, and let's start curing the patient instead of attacking the messenger. 73

The New Orleans Amateur Radio Association.

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

HAPPY NEW YEAR! As I am sitting in the Dungeon (my shack) I reflect on the past year and all the fun things that I have done, plus all the wonderful things that hams around the world have been doing or are planning to do. I certainly wish that I could attend many of the conferences, meetings, or just generally good times that are happening, but alas, I cannot. I sometimes wonder how Wayne does it, but he is a natural go-getter and no moss grows under his feet.

I am very happy to report that Wayne has been recruiting Hambassadors for the column. Harris Abdullah 9M6HF is the latest, and you will see his first installment in this month's column. Thank you, Wayne, from all of us.

What will the new year bring? I hope it brings complete world peace, better understanding between countries and individuals, and prosperity for all. I do know that the staff at 73 Magazine *will be striving to continue the excellence that 73 is known for, and that this column will bring you all the news from around the world.—Arnie N1BAC*

Roundup

Spratly DXpedition. *[This press release ended up in my box from an unknown source.]* The recent Spratly DXpedition was a major success, despite various problems. Romeo Stepanenko 3W3RR and a team of Soviet operators contacted over 43,000 stations worldwide in April–May of 1990. Many people and organizations banded together to donate funds for that trip and made it possible. However, there are still many amateurs who would like a shot at Spratly for a new one, phone or CW.

Romeo, well-known to the Vietnamese, can obtain a passage to the Islands on very favorable terms. His new expedition will take him *[or has taken him]* and one Vietnamese assistant to Spratly island for a week-long operation.

Donations will be greatly appreciated for this effort. They can be submitted to: Ed Kritsky NT2X, Box 300715, Brooklyn NY 11230, USA. If the total amount needed, $5,000, cannot be raised, all contributions will be returned to their donors.

Switzerland *From a press release of the International Telecommunication Union (ITU).* Taking advantage of new technologies available in the field of information retrieval, the ITU is now publishing the International Frequency List (IFL) on CD-ROM (compact disc—read only memory). The computer readable edition is an improved version of the existing IFL on microfiches.

From the first edition of the "Berne List" published in 1928, to the latest edition of the IFL produced on paper, the number of frequencies increased from 1,700 to about 1,100,000, representing an increase in the number of pages from 24 to over 6,000! This led the Union to cease the publication of the list on paper and to adopt microfiches as from 1985. The CD-ROM list is yet another step to make this publication more flexible and useful than ever.

The CD is used with the CD-Answer information retrieval software delivered on the accompanying diskette. You can access information by frequency, country code of station location, notifying administration, class of station, station name, geographical coordinates, or geographical area and region code. It also enables users to process any extracted subset of the database in local application systems.

Photo A. Famous Taiwanese ham BV2A/B, Tim Chen (in the middle), visited the Tokyo International Amateur Radio Association (TIARA) booth at the annual Harumi Ham Fair last August. With Tim, left to right, are TIARA Technical Advisor Ed Coan 7J1AAE; member VU2ST, Ali; President Frank Striegl 7J1AAL; and member Motoi Kawatsu JK1PNY.

Photo B. Father Marshall Moran (in the middle), world famous as 9N1MM, receives 10 Novice study guides from TIARA for his students in Nepal, where he has been promoting amateur radio for 35 years. Father Moran was in Tokyo last September at the invitation of the Japan UNICEF Ham Club. Also present (left to right) are Andy Clark 7J1AAD, TIARA President Frank Striegl 7J1AAL presenting Father Moran with Tune in the World, *and Brother Albert Heinrich 7J1ACI.*

Send inquiries to: I.T.U., General Secretariat, Sales Service, Place des Nations, CH-1211 Geneva 20, Switzerland.

MALAYSIA

Harris Abdullah 9M6HF
P.O. Box 13329
88837 Kota Kinabalu
Sabah Malaysia

Greetings from Malaysia. Amateur radio is alive and growing in Malaysia. Malaysian Amateur Radio Transmitters Society (MARTS) has been doing a tremendous job in promoting the hobby through participation in social and sports activities.

In 9M8-land, interest in amateur radio was generated when Special Event Station 9M8STA went on the air in August 1989 for three days. The first amateur satellite communication from Eastern Malaysia was made through this station. And this year, 9M8 hosted the Annual SEANET Convention held in Kuching from November 10–12.

Sabah, 9M6, has 29 licensed hams, but only eight can be heard on the HF bands on a regular basis. 2 meters is also active, and a repeater, 9M6RGK, has been installed at an altitude of 9,000 feet on Mount Kinabalu. At this height, the repeater's coverage extends as far as the northern part of V85-land, Brunei. The repeater was home-brewed by 9M6MA. It is easily accessed from Kota Kinabalu, about 40 miles away. The Sabah Amateur Radio Society represents the interest of the local ham population in 9M6.

There are many SWLs in Malaysia. Most have been able to pass the RAE Part I Examination (Theory and Regulations) but the main stumbling block is Part II, CW. Part I consists of multiple choice questions on theory, practice of radio communications, and the local regulations covering the hobby. Part II tests the ability of the candidate to receive and send messages in Morse code at 12 wpm.

Presently, there is only one class of license available. However, plans are underway to amend the regulation to provide for Class B (VHF only). This requires passing Part I of the exam only. Another change that may come soon is the lowering of the minimum age requirement from 18 to 16. The examinations are conducted twice a year in June and December by the Department of Telecommunications. Amateur radio licenses are valid for a year, and the fee is M$20.00 per year for fixed/mobile/portable operations.

Malaysia does not have any reciprocal licensing agreement with any other country at the moment. Hams who intend to operate while visiting the country need to submit an application form at least two months ahead of the arrival date, to allow time for processing. The issuance of a temporary license will be at the discretion of the licensing authority.

If you intend to operate from 9M2, write to MARTS, P.O. Box 10777, 50724 Kuala Lumpur, Malaysia for assistance. For 9M8 and 9M6, write: 9M8FH, Festus Havelock, P.O. Box 203, 93702 Kuching Sarawak, Malaysia, and 9M6HF (myself, address above).

The main problem hams face in Malaysia is the high customs duty levied on amateur radio equipment. MARTS is constantly working to have this reduced or removed for the sake of the amateur radio community. Importing an HF rig is costly, almost double the purchase price of the equipment. This is why there are not many licensed hams active on the HF bands.

SPAIN

Woodson Gannaway N5KVB/EA
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de G.C.)
Islas Canarias, Espana

Hello again from the Canary Islands. I am very happy to provide a translation of an article printed in a local newspaper about the hams in the province of Las Palmas (the islands of Grand Canary, Lanzarote, and Fuertaventura). Alfonso Hernandez, President of the Union de Radioaficianados de Espana (URE), provides the narrative for the reporter.

In the province of Las Palmas (the islands of Grand Canary, Lanzarote and Fuertaventura) there are approximately 800 ham radio operators, 650 of them on Grand Canary. On Lanzarote there are two local branches (in Teguise and Arrecife), and another on Fuertaventura. In all, there are 1,730 hams in the Canary Islands.

The URE was created before the Spanish Civil War, and then it disappeared. It began anew 27 years later, in 1963. Before the movement, there were only a few licenses, but they were easy to obtain. Quite different from the situation we saw later; although thanks to our "dean," Jose Callero, people kept up their interest, and began transmitting again when it was allowed.

In 1980 things began to settle down, and in those times, Las Palmas province had about 80 hams. New rules and tests were put into practice in 1983. In Las Palmas the URE chapter was changed to the form it has today, with its own jurisdiction, instead of being a branch of the Madrid office.

There is no average Canary ham. The strongest interest comes from young adults between 20 and 40 years old. There are older people too, but they have more problems in passing the tests.

Equipment normally costs around 500,000 ptas ($5,000), including installation of a multiband antenna. But at any rate, you don't need a rig to be a ham. You can become a club member and use the club callsign. Membership dues in Las Palmas are $60 a year.

In Las Palmas there is a packet repeater and two 2-meter repeaters. There is a 2 meter repeater on both Lanzarote and Fuertaventura.

Our ham services are largely emergency services, such as requests for medicine. We are constantly asked to search for medicine in all parts of the world; above all, this is a humanitarian service and not limited to our country's borders. When someone asks you to get medicine and you go to the trouble to get it and send it, and then they tell you that this has helped save a life, this makes you very happy. I think that it is things like this that a ham is proudest of.

To become a ham one must pass a series of tests that cover four areas: operating the equipment, basic electronics, pertinent Spanish law, and Morse code. The club offers classes to prospective hams. After passing these tests the ham receives a callsign prefix of "EC." He stays at this level for a minimum of 6 months while making 75 contacts (25 national and 50 international). Then he can test for "EA," the highest license category. If he wants to enter the "EB" class he has only to pass a written exam (no code). This class allows limited use of the VHF bands.

Until next time, 73 from the Islas Canarias.

Number 22 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525-4438, 8 data bits, 0 parity, 1 stop bit. Thank you for your cooperation.

Wanted: a Morse code trainer program for the Apple IIe to help boost a new Novice to 13 and 20 wpm. *T. Francis, Rt. 2 Box 336, Leonard TX 75452.*

I am looking for any info on KLM Electronics Echo II, 144 MHz transceiver. I will copy or pay for copy and postage. Contact *Rick Bogdan KA1UDX, 136 Samoset Ave., Hull MA 02045 or KA1UDX @ NS1N.MA.USA.NA.*

Elmer wanted! I have an FT-707, and study code on computer. I have books, but learn best by listening and doing. Please respond. Thank you. *James E. Fiuren, PO Box 2394, White City OR 97503. (503) 826-5190.*

I cannot locate a company called the Dentron Radio Corp., and I need circuit diagrams or operating manuals for the ant. tuner Dentron Jr. Monitor, Serial #6207. I will pay any cost involved. *Ray Terrill ZL1AAR, 3F Faith Bullock Pl., New Lynn, Auckland 1207, New Zealand.*

Can anyone tell me anything about a Zenith PM-1 cable system used for scrambling? Also, I'm looking for a copy of a book called *The Ten Meter FM Handbook*, by Bob Heil. It has been out of print for about 5 years. I will pay copying charges for this book. *Bret Singer N3IHM, PO Box 1015, East Stroudsburg PA 18301.*

I am interested in SSTV, but have no idea what kind of equipment I need, where to get it, or how much to spend. Any help I could get would be appreciated. I operate a TS-820 for HF (barefoot), and have a 3-element tribander. *Kevin Webster N1EPU, 1564 Byam Rd., Cheshire CT 06410.*

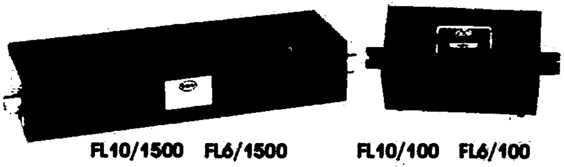
Needed: Info on full break-in CW. Does the B&W tube type break-in device still exist or does anyone have anything simpler to use with separate transmitter and receiver? *Bill Pierce, 142 South Keystone Ave., Sayre PA 18840.*

I need the manuals (including schematics) for Lafayette Signal Generator TE-20. *Meyer Minchen AG5G, 4635 SW FWY, Houston TX 77027. (713) 622-6161.*

I'm looking for information about parts or service for a Wilson WR-500 antenna rotator. Thank you. *Sam M. Barrett WA5RPP, PO Box 141, Presque Isle ME 04769.*

T.V.I. problems?

Low pass T.V.I. filters from Barker & Williamson



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FL6/1500	1000	55 MHz	63 MHz	70 dB	6 meter	$55.00*
FL6/100	100	55 MHz	63 MHz	50 dB	6 meter	$38.50*

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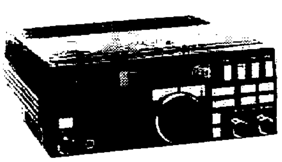

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Ham Television

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W1BHD-ATV Pioneer

While visiting the Boston area, I decided to drop by and visit Mel Dunbrack W1BHD, also known as the "Grandfather of ATV." At 84½ years of age, he is still active on ATV in the Malden, Massachusetts, area. Mel built his first ATV station in 1948 and was one of the first ATVers on the air in the world. One of the first known ATV demonstrations (non-mechanical) was an eight-mile contact between W2USA at the New York World's Fair and W2DKJ/2 at the New York Daily News Building on September 27, 1940 (see *QST*, November 1940). This demo inspired Mel to construct his own station. In the '40s, things such as TV sets, and particularly TV cameras, were a little hard to come by (at ANY price!). Mel set out to homebrew his very own TV camera and converted a RCA oscilloscope to operate as a TV receiver!

From Spark Gap to Video

Mel started out in amateur radio with a spark gap transmitter he constructed in 1917. His interest in ATV was first sparked during the '20s when he saw the ads for the Jensen mechanical TV system (anyone still have one of these?). He worked in the electronics field starting out at AMRAD and eventually working at James Millen Company. If you've ever owned one of Millen's grid dip meters, Mel probably had a hand in building and testing it!

During 1948, three TV stations started up in the Boston area. WBZ-TV started broadcasting on June 9, 1948, WNAC-TV came up on June 21, 1948, and by November 20, 1948, W1BHD-TV was on the air! Mel wrote the FCC about identifying his TV signals. He received permission to add the "-TV" suffix to his call.

Photo A. Mel Dunbrack W1BHD with his omni-horizontal portable ATV antenna.

Photo C. From Spark to Video. The W1BHD 1948 vintage TV camera can be seen in the background.

Soon Mel had a following of several local hams watching his test patterns and live demos. If you think it's tough to stir up ATV activity in the '90s, just think of the hard road that Mel had to follow in the late '40s! Mel's eventual goal was to stir up a *riot* of ATV activity. To help achieve his goal, he started up the first ATV newsletter in 1951, called the "American Amateur Television Associates." In his first few months he had nearly 30 members (see the list).

After years of stirring up new ATV activity, he was instrumental in helping Tony K1VTE get the Malden ATV repeater up and running in the mid-'70s. He also had one of the first 2 meter FM repeaters operational in New England (WR1AAA—the "Skunk Hollow" machine).

Mel is an active member of the ECAT group (East Coast Amateur Television, Inc.). Although he is blocked by a hill from the current repeater site in N. Andover, Massachusetts, he still enjoys operating simplex ATV from Malden. Give him a call on the 145.29 repeater and help him start another ATV riot!

Backpack ATV

While at this year's Boxborough, Massachusetts, hamfest, I was treated to quite a variety of portable ATV activity. The ECAT group (East Coast Amateur Television, Inc.) had an impressive booth which received the transmissions from several backpack ATV stations scattered about the hamfest grounds. Seen hoofing it were Jerry N1FFX (see Photo E), Bob WA1WVJ, W1ELX, Lynn W1NRE and at least one or two others. The ECAT group had even arranged for a tethered blimp ATV station, but high winds and rain put an end to those plans.

If you're planning a trip through the Boston area, look for the ECAT group on the 145.29 (−600) repeater in N. Andover. The KA1AFE ATV repeater is located at the same site as the 2 meter machine on top of Boston Hill north of the greater Boston area. The input is on 434.00 MHz or 911.25 MHz and the output is on 421.25 MHz (both vertically polarized). Activity nights are on Wednesdays and Sundays around 8 p.m. 73

Active ATV List–1951
(From the American Amateur Television Associates newsletter)

W1BHD	PA0VT
W1MUX	G3CVO
W9DDG	W4MS/W4RE
W2LMP	W3MLN
W6JDI	W5MSB
W6QT	W6OFU
W6VSV	W3NDB
W6UOV	W5ANR
W6WCD	W4GFF
W6RXW	W4LRG
W6VQV	W1QVF
W6MTJ	W1HDO
W6AQV	W2UTH
W6WGM	W8DMR

Photo B. The W1BHD ATV museum/hamshack.

Photo D. Image Orthicon tubes anyone?? (The W1BHD hamshack)

Photo E. Jerry N1FFX demonstrates his backpack ATV station in front of the ECAT booth (Ed KA1AFE behind booth).

Number 26 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the March issue, we should receive it by December 31. Please provide a clear, concise summary of the essential details about your Special Event. If your announcement arrives here too late to be included in the magazine, it will be entered in the /HAMFESTS SIG on our BBS, (603) 525-4438. 8,0,1.

DEC 30

SOUTH BEND, IN A Hamfest Swap & Shop will be held at the Century Center by the Repeater Valley Hamfest Committee. Tables: $5/5' round; $15/8' x 2.5' rectangular; $20/8' wall locations. Talk-in on 6.52, 99-39, 69-09, 34-94, 145.29. Contact *Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616. (219) 233-5307.*

JAN 12

WESTBORO, MA The MMRA Flea Market, sponsored by the Minuteman Repeater Assoc., Inc., will be held at the Westboro Senior High School from 9:30 AM–2 PM. Admission is $2, or $1 after 1 PM. 6' x 6' vendor spaces $5 in advance, $10 at the door; with table & chair—$10 in advance, $15 at the door. Floor space with table and chair will be guaranteed only when paid for in advance. Vendor space requests should be sent by Jan. 1, 1991, to: *1991 MMRA Flea Market, PO Box 2282, Lexington MA 02173.* Talk-in: 449.925, 223.94, and 146.61 MHz. Contact *Andy Morrison N1BHI at (508) 481-3878* or *Ralph McNall WB2DCL at (508) 366-2404.*

JAN 19

MONTEREY, CA Winterfest 91 Demonstration and Flea Market will be sponsored by the Naval Postgraduate School ARC at The Monterey Fairgrounds, Salinas Room, from 8 AM–3 PM. Admission is free. For info, contact *Pat at (408) 649-4444 (days)* or *Doug at (408) 663-6117 (evenings).*

JAN 20

YONKERS, NY The Metro 70cm Network will sponsor an Electronics Fair/Giant Flea Market at the Lincoln High School from 9 AM–3 PM, rain or shine. Free parking. Admission $4. VE Exams. Tables: $15 for the first and $10 for each additional, $1.80 per foot. Pre-registration deadline is Jan. 10, 1991. For tables at the door: $20 all tables, $2.50 per foot. Contact: *Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. (914) 969-1053.*

JAN 26

GALLATIN, TN The 300 Repeater Ham Festival will be at the Gallatin National Guard Armory on Highway 25 East of Gallatin. Setup begins at 6 AM. Open to the public from 7 AM–2 PM. Walk-in testing. Tables are 1/$5, additional $2.50 each. Bring extension cords. Talk-in on 147.84/.24 from 5:30 AM. Contact *Bill Ferrell N4SSB, 1120 Douglas Bend Rd., Gallatin TN 37066. (615) 452-3962.*

CRYSTAL RIVER, FL The 11th annual Citrus County Hamfest, sponsored by the Sky High ARC, will be held in the National Guard Armory on Seven Rivers Dr., starting at 9 AM. Admission $4 until Dec. 20, and $5 thereafter. XYL's free with OM. Free parking. Vendor set-up from 3–5 PM Fri. and 7–9 AM Sat. 120V AC available at no charge. Users must provide plugs, cords and tape for attachment to floor where cords cross aisles. All exhibitors and helpers must purchase admission tickets. Parking for self contained RV's. Outdoor fleamarket spaces $5. Indoor tables $8 each. All tables are 30" x 8'. Chairs provided. Make checks payable to *Sky High ARC* and mail to: *SHARC Hamfest, 9 S. Davis St., Beverly Hills FL 32655.* Send SASE for mail return or pick up tickets at the door.

ARDEN HILLS, MN Those interested in microwave operations are invited to attend a meeting at the Satellite City radio store at 10 AM. Free admission. Contact *Jerry Jensen (612) 888-6187.*

JAN 27

VILLA PARK, IL The Wheaton Community Radio Amateurs will hold their 24th Mid-Winter Hamfest from 8 AM–3 PM at the Odeum Exposition Center. Handicap accessible. Tickets $5 in advance with triple prize stubs, $6 at the door. All Flea Market tables reserved. Call *(708) 231-2428.* Talk-in on 145.39/.79, 224.14/2.54, 444.475/9.475. For commercial space, call *(708) 629-8889* or *FAX (708) 629-7098.*

COLUMBIA, PA The Columbia Area ARC will sponsor a Hamfest at the Columbia Markethouse from 8 AM–3 PM. Set-up at 6:30 AM. Admission $3. Tables $5. Free parking. VE Exams. Talk-in on 146.715/.115. Contact *Hamfest Committee, Columbia Area ARC, PO Box 574, Columbia PA 17512. (717) 684-5603.*

FEB 2

ST. CATHARINES, ONT. The Niagara Peninsula ARC Inc. will hold its 13th Annual Big Event Ham-fest/Dinner-dance at the C.A.W. Hall. Admission $3, tables $12 commercial and $5 non-commercial. Talk-in on 147.24/.84. For info please write *N.P.A.R.C. Inc., PO Box 692, St. Catharines, Ontario L2R 6Y3, Canada. (416) 562-4891.* Dinner-dance tickets available only in advance.

SPECIAL EVENT STATIONS

JAN 5-6, 12-13

RIO de JANEIRO, BRAZIL The Hunting Lions in the Air Contest, is sponsored by Lions Clubs International and coordinated by the Rio de Janeiro Arpoador Lions Club (Brazil). The CW portion of the contest will be held from 1200 GMT Jan. 5–1200 GMT Jan. 6. The Phone portion of the contest will be from 1200 GMT Jan. 12–1200 GMT Jan. 13. The contest commemorates the birthday of Melvin Jones, founder of Lionism. Its main objective is to create and foster a spirit of international understanding and cooperation among Lions and ham radio operators through worldwide communications. Bands permitted are 80, 40, 20, 15 and 10 meters, Phone and CW. For Phone: Calling: CQ...Hunting Lions in the Air, followed by callsign; Exchange: RST report, prefix and a sequential QSO number. An operator who is a member of a Lions, Lioness or Leo club shall indicate the word "Lion" and the name of the club. If possible, identify the district. The Rio de Janeiro Arpoador Lions Club members and the Melvin Jones Memorial Radio Club members will add the words "Arpoador" and "Melvin," respectively. For CW: Calling: CQ...Test Lions, followed by callsign; Exchange: RST report, prefix and a sequential QSO number. An operator who is a member of a Lions, Lioness or Leo club must indicate the letter "L": The Rio de Janeiro Arpoador Lions Club members and the Melvin Jones Memorial Radio Club members will add the letters "LA" and "LM," respectively. Make one log for each mode (CW and Phone). Clearly indicate the category (single operator or clubs and associations with multiple operators). Enter callsign, the band, the report and sequential number of QSO—both received and sent. QSO's in the different bands but in the same mode should be indicated in the same log. Logs must be mailed by Feb. 15, 1991, via airmail, to: *Contest Committee of Rio de Janeiro Arpoador Lions Club, PO Box 2155, Rio de Janeiro 20011, RJ., Brazil, South America.* Also, write to this same address for info about points and awards.

JAN 15-21

DULUTH, MN Duluth area hams will operate KB0DAV (Dogs After Victory), to commemorate the Eighth annual John Beargrease Sled Dog Marathon. Beargrease Amateur Radio Coalition (B.A.R.C.) provides a safety net for the health and welfare of the mushers and dogs during the 500 mile wilderness race. Operations will be on-going throughout the race, SSB and CW 10 through 80. For QSL send QSL and SASE to *BARC, PO Box 500, Duluth MN 55801.*

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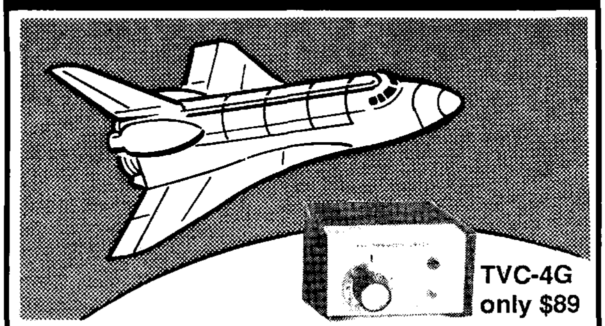

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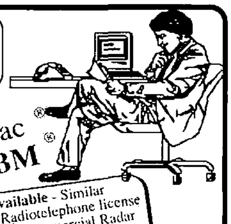

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Jim Bail KA1TGA, 73 Magazine Review Jan '90

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Gunn and IMPATT Devices

What is the difference between a diode and a Gunn diode? Why does an IMPATT (impact avalanche and transit time) diode check out like a diode, and a Gunn diode fail this test? This month we'll explore the internal characteristics of microwave diode oscillators, which will help you determine whether a device is still alive or a dud.

Most devices picked up at swap meets are in the realm of a trust relationship, as detailed testing isn't possible. But most cavities that appear from time to time at flea markets can be tested with simple equipment to help you determine the status and type of microwave device.

I have experimented with most of the microwave diodes available, and I try to pass on what I have learned in the process. The first rule is to look in the technical book section (621 division) of your public libraries. Using this privilege can save you lots of bucks. If you can't locate material there, you might want to check the nearest college library. I find myself continually looking for new material covering old ground. It helps explain what is going on, as it's simple when you can visualize the different devices.

The Basic Diode

The basic diode has one junction, a positive (P) and a negative (N) block of silicon. When you connect an ohmmeter across the diode (positive lead of ohmmeter to positive terminal [anode] of the diode, and negative lead to the negative terminal [cathode] of the diode), current will flow. The current is controlled by the voltage of the ohmmeter's battery and the meter/diode resistance. Some meters are better used on the times 10 scale, since the times 1 scale can supply more current, and could damage devices like detector diodes. See Figure 1 for the basic test circuit.

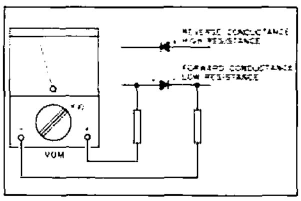

Figure 1. The basic diode test circuit.

When using the ohmmeter for testing a device, first note the reading in the forward biased direction, then reverse the meter leads. The reverse reading should be 20 times greater, or more, for a good diode. Some devices will indicate open or infinity on your ohmmeter. This is OK. The point is that the diode in conduction measures low resistance, and in reversed polarity, is very high or open to the meter circuit. This is a simple test for rectifiers, zeners (below reverse breakdown voltage), and similar devices. These devices can handle larger currents, such as the high currents the meter might apply to them.

Applying this type of test, you can destroy some microwave devices, since some junctions of transistors, especially FETs, can be punctured by the meter's voltage. If the device is a bi-polar transistor, you can get away with it, but be careful of the voltage and the amount of current that the meter supplies. Check the battery in your meter and its polarity in reference to the meter leads. It helps when the positive battery voltage in the ohmmeter test is on the red or positive side.

Don't use the highest meter scale. Stay on the times 10 scale to limit current. I use a Triplett model 630, 20k ohms per volt, to do my tests. On the X-10 ohms scale it uses a 1.5 volt battery for tests. This is my swap meet and general purpose meter.

IMPATTs and Gunn Oscillators

Let's get into the innards of the microwave devices and find out what makes IMPATT and Gunn diodes different. The basic difference lies in the materials used to construct each device. Both devices produce microwave oscillations at various power levels and are quite compact compared to the older tube systems they replaced.

The Gunn device is constructed of a triple layer of "N" type semiconductor, actually a very thin wafer a few microns thick (the actual Gunn surface). This active Gunn element is sandwiched between two "N" blocks of material allowing a bonding surface to the very thin Gunn material. As such, the Gunn device does *not* have a diode junction. Because the Gunn's three-piece construction consists of only one type of material, "N" type, it doesn't test like a normal diode. Why it is called a diode (implying two elements, anode and cathode) eludes me.

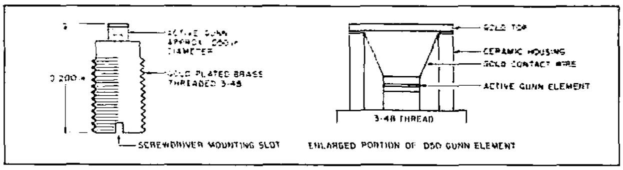

Figure 2. Gunn diode construction. Frequency of diode determined by thickness of Gunn diode wafer. A thick wafer indicates 6 GHz, a thin wafer indicates 10 GHz.

Testing a Gunn device with the ohmmeter will show a dead short of about 2 to 3 ohms in either direction. The problem is that this may be a good Gunn device! Reversing the meter leads won't help; you'll get the same reading. Remember I said the device has no diode junction and is constructed from a single (triple-layer sandwich) block of "N" type semiconductor material. What is required is some means of observing microwave operation in a cavity to check for microwave operation. See Figure 2 for the Gunn's structure. (Note: The Gunn device can operate using strip lines, but efficiency is very low, about 2%.)

The Gunn device is a bulk semiconductor (solid) that causes the DC electron flow through the material to bunch in clumps of electrons. These clumps or bundles of electrons represent pulses of current in a resonant cavity, and comprise the microwave period, or resonant oscillations. Cavity operation of Gunn diodes is the most efficient method used today to produce high power units.

I visualize this bunching effect by picturing ten thousand BBs rolling down a plank. Due to collisions and other factors, some electrons (BBs) slow down, while others speed up. The result is that they vary in speed, and bunch up at a rate that is the resonant frequency of the cavity. This output power obtained at microwave can vary from a few mW to over half a watt.

Gunn devices are voltage-fed, meaning they can have all the current they want to draw from the supply at a particular voltage. Please note that Gunn devices are polarity sensitive. They will not work with reversed polarity and most likely will self-destruct under this condition. If you have an unknown device, try it. You have a 50–50 chance of being correct. Most are positive, but a few are negative. If you have several surplus devices, check the circuit they came from for clues as to voltage polarity. If none are available, try them and hope for the best.

A sure giveaway of a shorted Gunn occurs when you apply DC power and it acts just like a 6/32 screw—a real ZERO dead short. A good Gunn will test like a a 2-ohm short, but when used in a cavity, it will only draw a certain amount of current, depending on the power rating of the device and its ohmic considerations. Some 100 to 200 mW devices draw 400 to 800 mA at 10 to 14 volts. A typical 10 mW device draws about 130 mA.

Gunn devices can test (ohmic) good, but not produce RF in a cavity due to poor cavity design or just a stubborn Gunn device. I have observed several troubles with Gunn devices, such as no RF output, shorted, and just plain cranky oscillators.

Testing Gunn Devices

With the Gunn device in a cavity, apply about 6 to 7 volts DC, taking note of the current which should be near normal for the power level of the device. At very low voltages the current might be excessive. Watch for microwave output and slowly raise the voltage towards 10 volts. Keep an eye on both the current and microwave output. The device will oscillate near its point of negative resistance. If it does not, make adjustments to your cavity circuit while watching for microwave output. Voltage should be set at or near 10 volts, but not higher for cavity adjustments. Once operation is OK, you can reduce the voltage to 5 to 7 volts and make a chart of the voltage vs. current readings. Your curve should look something like mine in Figure 3.

For brave souls who wish to determine the maximum voltage of their Gunn device, increase voltage slowly until there is no further increase in microwave output. Do not increase voltage above this point. Further voltage increases will result in device destruction. In most devices, the maximum voltage that can be used safely varies from 9 to 12 volts. You are TICKLING THE TAIL OF THE DRAGON AT THIS POINT. I do not recommend maintaining this voltage level for more than a short time. Back the voltage down about 1 volt.

I have destroyed many good devices by pushing this limit, and they don't give you a second chance. Keep the voltage at the setting for peak RF out or slightly less, and you will be OK.

IMPATTS Diodes

IMPATT diodes differ from Gunn diodes in that they have a diode junction and can be tested with an ohmmeter. They test just like a normal diode, checking for good front to back ratio. IMPATTS are current-fed, and as such are limited by a series resistor in the maximum amount of current they can draw. The power supply required for IMPATT diodes is much higher than that required for Gunn devices. IMPATTs require about 75 to 100 volts DC and current is usually limited to about 35 mA.

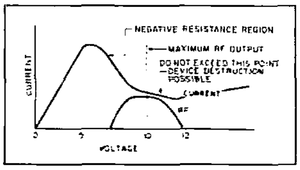

Figure 3. Gunn diode current vs. voltage curves.

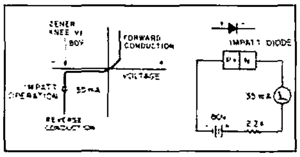

Figure 4. IMPATT diode operation. The IMPATT diode resembles a zener diode curve of operation. It operates in an avalanche current limited mode with 80 volts reversed biased at about 35 mA. IMPATT case style is identical to that of a Gunn device.

As noted, IMPATT stands for IMpact Avalanche Transit Time. Sounds like electrons doing their thing, rolling down the plank. However, the effect is part of an avalanche breakdown and the transit time of electron flow in the device (similar to zener action). It has to be controlled partly by device construction and by limiting current to a safe value. If current was not limited, the device would run away instantly and self-destruct. The breakdown regions of a zener and an IMPATT diode are nearly identical. Zeners can be made to operate as IMPATTs, but not all of them will function as IMPATTs, and those that do will be very inefficient.

I have several IMPATT oscillators, and they are very fussy compared to Gunns. Designing circuits with IMPATT devices can be very touchy, as several circuit designers demand tight guidelines in limiting substitutions between devices. They work well, but are critters unto themselves, and are not very design-forgiving. I have had poor luck replacing a defective IMPATT with surplus devices. However, using the IMPATT sources as they came from surplus, I have found them well-suited for beacon operation. This is due to a higher cavity *Q* and resultant frequency stability. If you want an IMPATT system I recommend you obtain a good commercial new or surplus device.

The surplus unit we found was manufactured by Raycon, part #10000-104-02, and provided 100 mW output at 80 volts/35 mA. N6IZW's beacon on Mt. Helix in San Diego County was based on this unit. The 10 GHz beacon, in use for over two years now, has worked well. The high *Q* cavity of the IMPATT oscillator helps minimize external influences, making the oscillator less sensitive to frequency pulling. Temperature, humidity, drafts, and the environment are all hostile to beacons, not to mention constant operation. The enclosure used to protect this beacon is a short section of plastic sewer pipe fully containing the oscillator and waveguide slotted antenna.

Mailbox Comments

Albert KC2MI of the Oneonta ARC in Oneonta, New York, writes that several club members would like to get started with microwave experiments, as that part of the radio spectrum is new to them. He reports that they were given several Gunn oscillators with defective devices. Albert is looking for 24 GHz equipment to place several stations in operation on that band as well. His address is RD #2, Box 325, Oneonta NY 13820.

Lyle Patison VK2LU is planning a talk on "starting out on 10 GHz" to amateurs "down under" at a local radio club. Lyle says he's been interested in 10 GHz operation for many years, and has a wideband unit (20 mW), and a narrowband transceiver (SSB, CW, NBFM) with 1 mW of output power. This unit injection locks a 30 mW oscillator for the final amplifier. The injection lock is accomplished using a circulator, and the resultant SSB output is quite good. He uses a 20-inch dish with a Cassegrain feed. He also runs a local beacon on 10.368270 GHz with 12 mW output that has EPROM identification.

Lyle's narrowband gear was home-built mainly from modified English designs. He is trying to get more activity on this band in Australia, hoping that talks at the local radio clubs will perk up interest.

Ace K5AR would like more information on toroidal transformers and spike reduction for the power supply project (see the August 1990 issue of *73*). I haven't found the answer in surplus on the transformers yet, but the spike reduction can be limited by the addition of a 0.1 µF cap and a series 5 ohm resistor from drain to ground. You might have to vary the capacitor value somewhat for maximum spike suppression. Observe on a scope and adjust the capacitor trimming for your switching rate.

I still have Gunn devices available for 6 and 10 GHz with 50 mW devices priced at $5 each, and devices up to 100 mW for $10 each postpaid. Additionally, I am looking for photo-multiplier tubes for use in a laser communications system that I'm building. Of particular interest are the types that use the top of the tube for input. Any help in locating the photo-multiplier tubes would be appreciated. When the system is in operation, I will publish full details on its construction.

As always, I will be glad to to answer any questions related to our VHF/UHF microwave bands or similar topics. Please send an SASE for prompt reply. 73's Chuck WB6IGP

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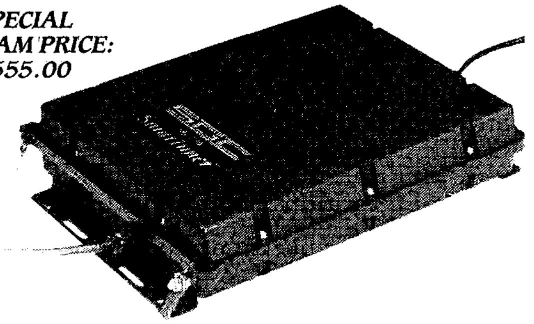

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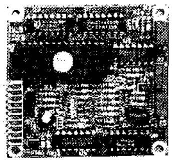

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Getting on AMTOR

Aside from the usual New Year's resolutions, such as losing weight and quitting smoking, here is one resolution you just have to see through: QRP AMTOR. Last April I treated myself to a new AEA PK-232 multimode controller, vowing that someday I'd give AMTOR a try. Well, that is exactly what I did, and I can say without question that QRP and AMTOR is a hard combination to beat.

I'm not going to try to explain AMTOR from the protocol level up, but rather share some good on-the-air experience I've learned through trial and error. Some of my mistakes might help others get on the air with AMTOR.

What You Need to Operate AMTOR

First, you'll need one of the multimode controllers. I picked the PK-232 because of the vast amount of software written just for it. You have your choice of the PK-232, the KAM all-mode, or the MFJ-1278 terminal unit. All of these are excellent and will work just fine for AMTOR. Besides the controller, you'll also need a computer or terminal unit. I opt for the computer, as you can operate dedicated software to really enhance the operation of the multimode controllers.

Some software programs are written just for a specific controller. In most cases, you can't use a program written for the PK-232 and expect the software to work correctly with an MFJ controller. Both MFJ and Kantronics offer specific software for their controllers. There are also third party software companies selling programs for any controller. Sometimes you can find outstanding software for a controller on a local BBS. CompuServe's HamNet has a huge data library full of programs for multimode controllers.

If you don't have a computer, that's all right, tool A dumb terminal will work, but you'll have to put up with the lack of specialized software. This means you won't be able to use split screens to separate transmit text and receive text. The dumb terminal will allow you to communicate to the multimode controller, and that's all.

Your Rig and Power Supply

You'll also need a radio that will operate full QSK break-in. Many of the newer rigs will do just that, but check carefully beforehand. I've used Ten-Tec rigs (both the Argosy and the Argonaut 509) and have had no trouble at all running AMTOR. In most cases, you can't use the break-in VOX; it won't switch fast enough for AMTOR. And, although this doesn't apply to QRP, if you run an amplifier, be sure it will also operate at full QSK.

Since AMTOR is almost 100% key-down (depending on your mode, FEC or ARQ [see next paragraph]; FEC mode IS 100% key-down, while ARQ is not, but it still demands a lot from the power supply), power supplies will be taxed to their limit. Make sure you have a good supply of cool air flowing around the transceiver and its power supply. Keep things cool, and you'll save yourself a lot of problems.

AMTOR Modes

AMTOR has two basic modes: FEC and ARQ. These are also called Mode B for FEC and Mode A for ARQ. Without getting into the why and wherefore of either mode from a protocol standpoint, all you need to know is this: To call CQ, use FEC or Mode B. This is a simple forward-error-correcting control for sending each character twice. FEC is used to call CQ, or for net operations and even for bulletins. FEC sounds very much like RTTY. In fact, after a while, you'll be able to tell by the sound of the FEC signal whether or not a station is calling CQ.

Mode A, or ARQ, is a synchronous system transmitting blocks of three characters at a time. ARQ has the characteristic chirp-chirp sound that makes AMTOR stand out on the bands. It is in this mode that you need full QSK for proper AMTOR operation. After you have called or answered a CQ, switch to ARQ mode. (To make life easier, if you call CQ and someone answers you, the controller will automatically switch over to ARQ, assuming the other station answers you in ARQ.)

This has been a very simple look at AMTOR. To get on the air and start making contacts is really quite easy. Be sure to get all the proper plugs connected to the multimode controller and the radio. This includes the microphone and audio out to the controller. Most AMTOR is on 20 meters, and in lower sideband, so you'll have to switch to the proper sideband if you want to start off with the right foot. On the Ten-Tec rigs, I have to choose the proper sideband by setting the MODE switch to SBPR. Also, with the Ten-Tec Argosy, the digital readout will now be off by about 2.5 kHz. Keep this in mind when trying to dial up a BBS on AMTOR.

From either the software or a dumb terminal, if you're using one, you'll have to include a SELCAL. This identifies your station. You *must* have a SELCAL, or AMTOR won't work! SELCAL is simple to add to the controller's memory. In most cases you drop your second letter and number from your call. For example, my call is WB8VGE and my SELCAL is WVGE.

With this out of the way, we can start. As I said, most of the AMTOR activity can be found on 20 meters, from about 14.070 to about 14.082, give or take a few kHz.

If your software will allow it, make up a CQ buffer or text file. Use the standard 3X3 call, but be sure to include your ARQ SELCAL! If you don't, no one will be able to sync up with your station. After you have a file or buffer, go to FEC and send the file. Your transmitter will come on-line, and you'll be in 100% key-down. After the file has run out, switch to standby mode and wait to see if you get an answer. If you do, you'll know instantly. The transmitter will start switching on and off very fast, and you'll be able to see what the other station is saying on the monitor.

If you get no response from your CQ after a while, tune up and down the band and look for a solid RTTY-like tone. This is an FEC. On the PK-232, tune until both the right-most and left-most LEDs are as brightly lit as possible.

The tuning indicator on the PK-232 leaves a lot to be desired, but after a while you can get the hang of it. When the FEC signal is tuned in properly, the controller will switch from standby to FEC. At this point, you should see something on the monitor. Look closely for the stations's SELCAL. When the station goes to standby, switch to ARQ and send *his* SELCAL. Your transmitter will start switching on and off, asking for the other station's SELCAL. When the two sync up, you're connected. At this time you can chat to your heart's content.

Perfect Copy at QRP

At this point, more than likely you're wondering what all this has to do with low-power communications. Well, with AMTOR, you get 100% perfect copy at very low power levels. I've had two-hour QSOs with DX stations running no more than one watt RF output! Of course, there were a lot of Repeat Requests (RQs) between the two stations, but we did manage to type away.

Running QRP AMTOR is slick! Things might slow down, but you can still hold a QSO. There are several things you should try to remember. First, since AMTOR generates 100% perfect copy on both sides of the QSO, you don't need to repeat anything! Don't ask "How's the copy?" when you know it's 100% perfect on AMTOR. LEARN HOW TO TYPE. Nothing is worse than talking with someone who can't type. Now this does not mean you have to do 80 words per minute, but you should do better than the 'ol hunt-and-peck method.

I also found out that you you can't adjust anything while AMTOR is running because of the rapid on-and-off switching of the transmitter. So be sure the SWR is correct, the power level is where you want it, and the audio gain is correctly set. I tried to adjust the antenna tuner while operating AMTOR. No way!

If you have not tried AMTOR QRP, you're really missing out on some great times. Give it a try. You won't be disappointed!

Coming Soon

Before we run out of space this time, I want to mention that I've got several really useful projects lined up for the upcoming months. The first project will be a universal T/R sequencer. This unit will control all the switching requirements that the active QRPer might need. The T/R controller will handle just about anything you can throw at it. I'm using mine for T/R controlling of an old Drake R4-B receiver and a host of home-brewed transmitters.

There are ample inputs for up to six different keying methods. These can include a straight key, bug, electronic keyer, and even a computer. All inputs are isolated from the transmitter/receiver circuits. You can adjust the T/R delay from the front panel as well as the internally generated sidetone. A separate T/R relay switches the antennas from a remote location. The entire circuitry requires 12 volts at 40 mA.

Best of all, all parts, and I mean ALL parts, can be purchased new from Radio Shack. The photos show two versions of the controller I use: One for the shack and the other for the workbench. Everyone should have one of these in the shack. Sure saves frustration when testing and building QRP transmitters. So get ready and heat up the soldering iron for next month. 73

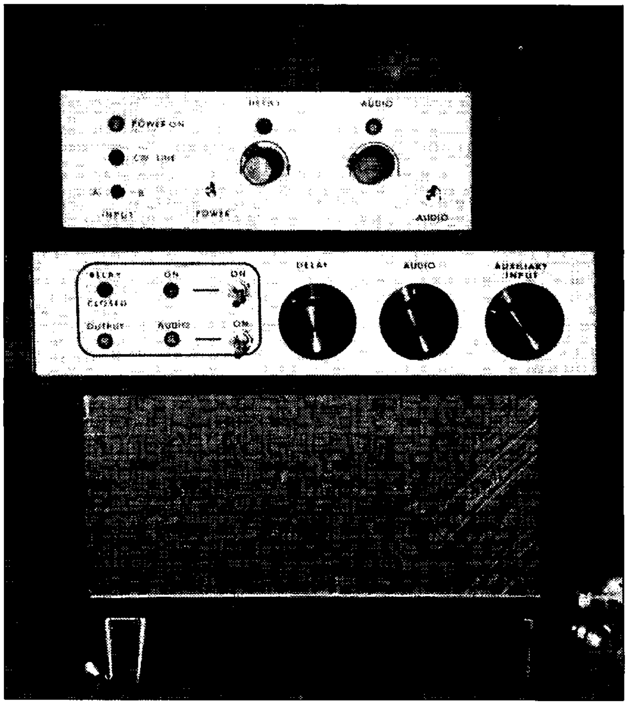

Photo A. Version one of the T/R controller every ham shack should have—next month's project!

HAMS WITH CLASS

Carole Perry WB2MGP
P.O. Box 131646
Staten Island NY 10313-0006

Ham Homeroom

Through a wonderful twist of fate, this term I wound up as the homeroom teacher for the top 8th grade class at intermediate School 72 in Staten Island, New York. I was excited at the prospecl of working with a group of gifted youngsters, but I was especially delighted to see the familiar names on the class register. Many of the children had been in my 7th grade ham radio program last year. Imagine my delight in learning that almost 50 percent of my homeroom students were licensed amateur radio operators!

What a year we've been having! By 7 a.m. many of the youngsters are at the classroom door, eager to get into Ihe shack. For 45 minutes every morning the young hams are busy swapping stories about their contacts of the night before, and looking up addresses in my callbook.

While I'm busily tending to the duties of a homeroom teacher, I delight in looking toward the station and seeing the kids having a ball on the radio. Almost every morning they greet the local hams on the 2 meter repeaters, and then move over to 10 meters and 20 meters. Inevitably, they get caught up in an interesting QSO, and they're still engrossed when the first period bell rings. I must admit I find it very difficult to admonish them about this.

Fortunately, their first period teacher understands the "pull" of the radio with these youngsters, and kind of looks the other way because he knows the kids are with me at the ham shack. One of Ihe benefits of having a successful ham radio program in a school is that the staff and administration become aware of the value of the program to the entire school. The children who have been in the ham radio program are always contributing interesting anecdotes and information to their social studies and science classes. There is a tremendous respect and appreciation by other teachers who know what the program can offer to the children.

Novice Follow-Up

It has been a real treat for me to be part of the follow-up for these newly licensed operators. Very often we lose the Novices after the course is over because they lose contact with a ham who can continue to work with them. By having them "under my wing" in the homeroom after they've gotten licensed, I can provide more follow-up activities for them and help steer them into the waiting arms of the local clubs.

The ham radio setup in my room allows the children to meet with each other and to have fun making contacts together. Some of these students don't have a radio at home yet. Since they've been given a chance to use the school equipment every morning, they've begun to realize how much fun getting on the air can be. Anyone who deals with youngsters knows that having fun is a contagious activity. Always try to provide the environment and ingredients in a learning situation for the children to enjoy themselves and feel good about what they're doing. Amateur radio can provide you with all the components needed to make every child feel special.

It's a good lesson for all of us to remember that it's important to provide the next step for Novices. Getting licensed is only the beginning.

What We Enjoy

While speaking to these highly motivated, terrific kids one day, I asked them what they enjoyed most about amateur radio. Perhaps you can share their responses with other youngsters.

Mary Alestra KB2IGG: Age 12, Extra Class. "There's no doubt about why the kids in our ham radio class at school are bright-eyed and perky in the morning. We all look forward to starting the morning with a contact on the air. All of us love the warm, welcoming good morning we receive from our many ham friends on the local repeaters. It's also a real thrill for us to make a contact overseas with a country we've been learning about in our social studies class.

"Many of the things we learn each morning at the school ham shack are helpful to us in setting up our shacks at home, and in learning how to operate properly and courteously. I also love meeting other kids on the 'CQ All Schools Net' and becoming pen pals with many of them.

"Here at Intermediate School 72 we know how to get going in the morning: eat a good breakfast and get ready for a great contact to start the day."

Mike Mlkos KB2JNB: Age 12, Technician Class. "Ever since I received my license I've made some exciting contacts. My rig is a Uniden HR-2600 putting out 25 watts into a Cushcraft AR-10. Some of my best DX contacts have been with Germany, Japan, Spain, Madeira, Portugal, Austria, Africa, Panama, England, and Italy.

"But one of my most memorable contacts, even though it wasn't a new country, was when I talked to a Cub Scout group in New Jersey. I loved talking to the kids and answering their questions about ham radio. I really hope I got some of those boys interested in the hobby.

"I've had my license for seven months and I haven't gotten tired or bored at all. I really enjoy it and I'm sure I will continue to have fun in the hobby for many more years."

Nicole Macellari KB2KXO: Age 12, Novice. "The first time I got on the radio was in Mrs. Perry's homeroom class. I was so scared. But Mrs. Perry stood right next to me and introduced me to Lionel KA2VBL on the air. He was so friendly and so nice that I forgot my nervousness and just enjoyed myself. I feel more confident every time I get on the radio now.

"Ham radio has been a help to me in many of my school studies. I recently had an interview for the Japanese Student Exchange Program at our school. I know that the fact that I had an FCC license was very impressive to the interviewer. I can now see why so many people are proud to be hams. Ham radio is fun for me, and I plan to upgrade soon."

Shaun Gartenberg KB2JNW: Age 13, Novice. "Ham radio is one of the most interesting and fun hobbies I have. There are so many people I've gotten to know on my ham radio. I really enjoy DXing on 10 meters. I find it very exciting reaching foreign countries.

"My father is also a ham. Many times we talk to each other when he leaves the house. Also, one of my best uses of ham radio takes place in school in Mrs. Perry's classroom. In case I've forgotten a book at home, I can call my father right from Mrs. Perry's ham shack. The other kids like to watch me when I do this. Ham radio is a great hobby for kids!"

Jared Greenberg: Age 13. "For the last two years at my school, I have not been able to get into the ham radio class. Fortunately for me, my homeroom class this year has many other students who have gotten their licenses, and my homeroom teacher teaches the ham radio course.

"When I first came into the classroom, I saw a lot of equipment in the back of the room which looked very complicated to operate. It seemed interesting, especially since Ihe other kids were always talking about it with Mrs. Perry. As the days progressed, I watched everyone as they used the equipment. It seemed like fun.

"A few days ago, Mrs. Perry invited me to the radio and began showing me how some of the equipment worked. She suggested I speak with a friend of hers on the air to see if I liked it. I remember how great I felt when the person I spoke to told me he liked the way I sounded on the air. Now I understand why people love speaking on the radio so much. With Mrs. Perry's help, books, cassettes, and lots of determination, I hope to obtain a license so I can speak on my own, as well as more often. I think I've found another hobby."

As teachers, we must never forget the enormous influence we exert on the lives of the children we see every day. Imparting knowledge is but one of the important things we do for our kids. Providing the environment for growth, both socially and academically, is imperative. Set up a ham shack where youngsters can operate and have fun together, then just stand back and enjoy watching the fruits of all your hard labors. It's what teaching is all about.

I recently saw the following article (see the sidebar) in a teaching magazine and cut it out and hung it over my desk at school. Please share this with other instructors and educators. It says it all. ■

All I Ever Really Needed to Know I Learned in Kindergarten

by Robert Fulghum
reprinted from *Kansas City Times*, Sept. 17, 1985

Most of what I really needed to know about how to live, and what to do, and how to be, I learned in kindergarten. Wisdom was not at the top of the graduate school mountain, but there in the sandbox at nursery school.

These are the things I learned: Share everything. Play fair. Don't hit people. Put things back where you found them. Clean up your own mess. Don't take things that aren't yours. Say you're sorry when you hurt somebody. Wash your hands before you eat. Flush. Warm cookies and milk are good for you. Live a balanced life. Learn some and think some and draw and paint and sing and dance and play and work every day some.

Take a nap every afternoon. When you go out into the world, watch for traffic, hold hands, and stick together. Be aware of wonder. Remember the little seed in the plastic cup. The roots go down and the plant goes up and nobody really knows how or why, but we are all like that.

Think of what a better world it would be if we all—the whole world—had cookies and milk about 3 o'clock every afternoon and then lay down with our blankets for a nap. Or if we had a basic policy in our nation and other nations to always put things back where we found them and cleaned up our own messes. And it is still true, no matter how old you are, when you go out into the world, it is best to hold hands and stick together.

Some of the students in my homeroom, left to right: Gabriel KB2KYF, Marc KB2KYJ, Shaun KB2JNW, Naomi KB2JRH, Nicole KB2KXO, Wendy KB2KXV, and Mary KB2IGG.

Number 30 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Space Symposium 1990

Over 225 enthusiastic AMSAT supporters escaped the daily grind and "normal" ham radio the weekend of October 19–21, when the Johnson Space Center Amateur Radio Club in Houston, Texas, hosted the 1990 Space Symposium and AMSAT General Meeting. It was a great success, with the largest attendance since Los Angeles in 1984.

During the three-day period, 22 papers were presented on topics ranging from introductory information on getting started with amateur satellite activity, to scientific studies of AMSAT-OSCAR-13's orbital decay and microsat stabilization methods.

Most symposium papers were presented at the JSC Visitor's Center on Saturday, October 20, while the Friday and Sunday talks took place at the King's Inn adjacent to the space center.

AMSAT'S Future

Since the launch of four Microsats in January 1990, the amateur satellite community has been concerned about the direction AMSAT will take in the next several years. Funding for the ambitious Phase 4 geostationary satellite program has not materialized. AMSAT North America has not begun any new programs beyond software development for the current hamsats.

Phase 4 satellites would be long-life, stabilized amateur communications platforms at 22,000 miles out over the equator. The design, construction, launch, and orbital maintenance needs of a spacecraft of this type exceed the current resources available to AMSAT-NA.

Photo A. Allan Fox N5LKJ (one of Houston's AMSAT Area Coordinators) won the grand prize, an ICOM IC-275A, at the AMSAT Annual Meeting.

Dr. Karl Meinzer DJ4ZC of AMSAT-DL (Germany) presented a report on the Phase 3D Project supporting a new-generation, high elliptical-orbit, long-life hamsat. Although he did not submit a paper for *Proceedings*, he had an article, "Radio Links to Phase 3D," published in the May 1989 issue of *73 Magazine* in which you'll find many of the concepts of a high-power version of our currently operational A-O-13. Phase 3D could provide 6 to 15 dB better performance than A-O-13 from the VHF to microwave frequencies anticipated for the onboard transponders. A 6 dB improvement on our current Mode B (70cm up and 2 meters down) A-O-13 system would mean less antenna on the outside or no amplifier on the inside of a typical ham shack. For the higher frequencies with as much as 15 dB gain over current systems, signals could be heard and transmitted with small helix antennas or simple balcony-mounted yagis. This would be an advantage for those hams confronted with antenna restrictions or limited space.

Many experiments and transponders have been proposed for the new satellite. The communications equipment may range in frequency usage from 29 MHz to 10 GHz. Popular transponder configurations like "B" (70cm up and 2 meters down) and "L" (23cm up and 70cm down) would be supported, in addition to possible modes yet undefined. Experiments could include a camera, radiation and impact sensors, and an ionospheric experiment.

Participants in the new program would be from many countries. Countries currently represented include the U.S., Germany, Italy, Japan, South Africa, Australia, Hungary, and Yugoslavia. Others may join later.

Dick Jansson WD4FAB was prominently involved with the development of the Phase 4 concept and its physical design. His presentation, "The Phase IV Project—A Transition to Phase 3D," showed how AMSAT can apply much of the technology created for Phase 4 over the last three years to the Phase 3D program proposed by AMSAT-DL.

The cost for a Phase 3D satellite would be almost as much as for the Phase 4 satellite, but it would be shared internationally. Rather than go alone, with no funding, the AMSAT Board of Directors voted to discontinue Phase 4 efforts and support worldwide endeavors to make Phase 3D a reality.

The Decline of OSCAR-13

An item of exceptional interest and study has been the decline of A-O-13's orbit. The October 1990 "Hamsats" discussed findings on the eventual reentry of the satellite. Dr. Tom Clark W3IWI arrived at the AMSAT Space Symposium armed with charts, data, and some intriguing slides showing the mechanics of the situation in great detail. Using some very powerful computers, Tom was able to project different orbital scenarios into the future.

The current situation shows that the changes to A-O-13's orbit will cause the perigee or low point of the orbit to decline into the upper reaches of the atmosphere after 1995. Very small changes to the initial conditions of the launch or kick-motor firings could have had a dramatic effect on the orbit. One situation Tom described would have allowed A-O-13 to achieve a somewhat stable orbit with minimal perigee decline. Another possibility would have brought A-O-13 back to Earth within a few years, around 1992—much earlier than anyone would have guessed.

The Microsats

Many of the papers presented per-

Photo B. Gil Carman WA5NOM operates the hamsat station permanently located in the Visitor's Center.

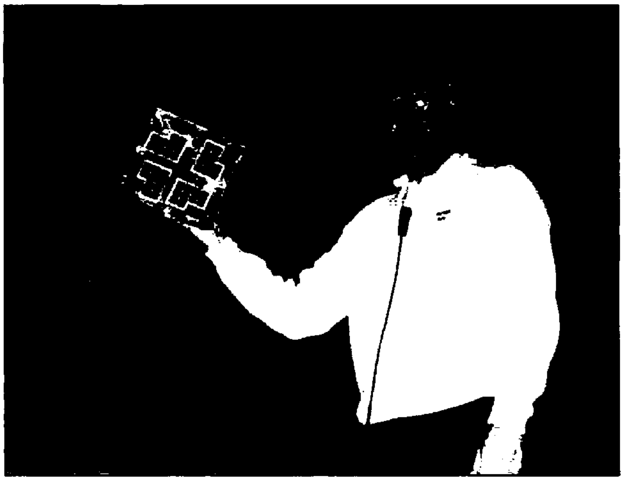

Photo C. Jim White WDØE explained Microsat motion, stabilization, and telemetry at the Space Symposium.

Photo D. Lou McFadin W5DID of the JSC ARC, and ham astronaut Jay Apt N5QWL of STS-37, with SAREX gear ready to go.

Photo E. Bill KB7KCM demonstrates antenna deployment of ADSAT to those at the AMSAT Space Symposium.

tained to the current state of the four Microsats launched in January 1990. The Microsats include AMSAT-OSCAR-16 (PACSAT), DOVE-OSCAR-17, WEBER-OSCAR-18 (WEBERSAT) and LUSAT-OSCAR-19. Much of the flight software has been difficult to develop, but the satellites are doing very well physically.

AMSAT V.P. Engineering Jan King W3GEY discussed the "In-Orbit Performance of Four Microsat Spacecraft." All design parameters of the program were met or exceeded.

A typical Microsat weighs 10 kilograms, generates 6 watts per orbit from its solar array, transmits a 2.4-watt output signal, rotates once per minute along its "vertical" or "Z" axis and stays at a cool 0.2 degrees Celsius.

Jim White WD0E addressed the issue of satellite stabilization, motion, and telemetry. Using a Microsat model, he showed how the satellites move and rotate relative to the Earth during each orbit. He also explained the importance of monitoring telemetry and described which parameters were measured onboard the spacecraft. Jim conveyed an in-depth understanding to the audience of how the Microsats move and function in orbit.

Steve Jackson WD8QCN, Chris Williams WA3PSD, and others from Weber State University explained the WEBERSAT camera experiments, the micro-meteor impact sensor, 1265 MHz video uplink receiver, horizon sensors, light spectrometer, and video flash digitizer.

Many digitized packet pictures have been received and displayed by enthusiasts, but the other experiments have not had the same level of publicity till now. As the students and staff at WSU gain more experience with the camera system, the pictures will improve and time will be allocated for work on the satellite's diverse functions.

David Liberman XE1TU presented a rather technical paper co-authored by Dr. Arcadio Poveda of the National Autonomous University of Mexico (UNAM). The paper and presentation described a Microsat project involving meteor-scatter radio propagation. While meteor scatter has been used by hams and others for communications between terrestrially-based stations, it has not been observed from the vantage point of satellites. Such a study will provide an opportunity for the UNAM to participate in a future Microsat project.

SAREX

It is hoped that by the time this is printed, STS-35 will have completed its mission with Ron Parise WA4SIR using packet and voice from orbit. Ron talked to the symposium attendees about the goals of his flight and the progress to date.

Lou McFadin W5DID brought the hardware for the Shuttle Amateur Radio EXperiment (SAREX) slated for launch with STS-37 in the spring. Two ham astronauts on STS-37, Jay Apt N5QWL and Ken Cameron KB5AWP, were available to talk with symposium participants about the mission. Lou's paper in the *Proceedings* provided real insight to the many challenges encountered in the course of satisfying NASA requirements to get a payload on the shuttle. The documentation requirements have produced a bookcase full of material just for the simple voice and packet station of STS-35. With the addition of SSTV and FSTV equipment for STS-37, the requirements were even more stringent. The SAREX volunteers have provided many hours of effort on the project. SAREX is a continuing project as long as we have hams on shuttle flights.

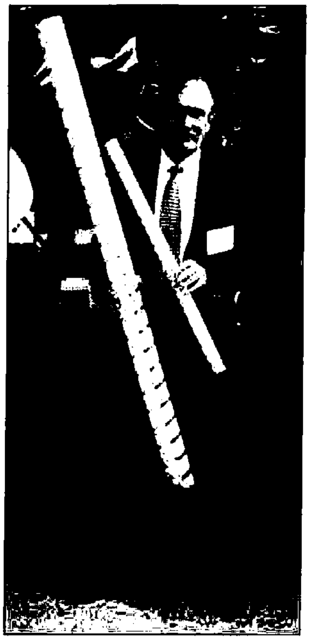

Photo F. Dick Jannson WD4FAB holds Phase IV helix antennas for 13 and 23 cm.

Additional Projects

During the weekend, the AMSAT Board of Directors considered many future amateur satellite experiments.

The work by AMSAT-Italy on ITAMSAT, an advanced Microsat, has passed the drawing-board stage with a nearly-completed flight-test model. Alberto Zagni I2KBD and his group have improved the original Microsat computer design. A launch in 1992 or 1993 is expected.

Other programs under study, or now entering the design phase, include SEDSAT-1/OSCAR, ADSAT, the Solar Sail, and efforts by AMSAT-Australia to work on a Microsat of their own.

SEDSAT would be an amateur radio device as a part of the Small Expendable-Tether Deployer System slated for a Delta-2 launch in a few years.

ADSAT stands for Astronaut-Deployable Satellite proposed for a shuttle mission. The project, conceived by Bill Clapp KB7KCM at Weber State University, has also been called pizzasat due to its similarity to an extra-thick pizza box with an antenna.

The Solar Sail efforts of the World Space Foundation need a communications and control system that could be designed by AMSAT along with a ham radio transponder system.

AMSAT Australia has just begun early design efforts, but has the capability to produce a Microsat.

You can find details of these projects and others in *Proceedings of the AMSAT 1990 Space Symposium*, available from AMSAT for $20.00. Write to: AMSAT-NA Headquarters, 850 Sligo Ave. #600, Silver Spring MD 20910-4703, or call (301) 589-6062.

AMSAT members can get the particulars of AMSAT programs and organizational changes from the minutes of the Board of Director's meeting as published in *The AMSAT Journal*.

Photo G. (Left to right.) AMSAT Director Tom Clark W3IWI reported on A-O-13's orbital changes and decline. AMSAT President and Director Doug Loughmiller KO5I fielded questions with Dr. Karl Meinzer of AMSAT-DL on the next generation of high-orbit amateur spacecraft. AMSAT Director Bob McGwier N4HY described both the AEA and TAPR DSP modems.

Number 31 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

The Big Lie

This month, I was going to continue with last month's topic: getting young people excited about amateur radio. I got about halfway into a column suggesting different ways to make amateur radio exciting to kids, but my mind kept returning to the same thought: "Why write about getting kids excited about ham radio when the root problem goes much deeper. Why not just talk about the REAL problem?"

Here it is. The single biggest reason why there are not more young people involved in amateur radio in the United States is that the vast majority of active licensed radio amateurs do not want more young people involved in amateur radio.

That's right, folks. Mr. John O. Ham doesn't want to share his ham bands with kids. Judging by their actions, most hams are doing everything they can to keep anyone under the age of 21 from getting involved in amateur radio. In fact, most hams don't want ANY new hams. . .of any age.

Now, before the regular group of goofballs gets out their crayons and scrawls me nasty letters, let me say that yes, there are many individuals and groups of hams who are actively involved in recruiting youngsters for amateur radio. I mentioned a few of them last month. Yes, there are a few hams who do not have a prejudice towards kids, and they're doing great work. Unfortunately, these folks are a tiny minority of active hams.

The vast majority of our fellow radio amateurs do not want more youngsters in this hobby. Do you need proof? Bring a youngster to a radio club meeting. Go ahead. Do it. Then stand back and watch the outpouring of indifference showered upon this youngster by the members of this club. I've seen it with my own eyes, and I would be willing to bet that out of 20 club meetings there would be maybe one or two where someone would actually approach the child and welcome him to the club (that is, if the kid could stay awake long enough to get through the reading of the minutes of the last meeting, the 45 minute discussion about the purchase of $50 worth of coax, and the 20 minute argument about where to hold the club picnic this year).

You want more proof? Listen to any active repeater in any populated area. What happens when the sound of a young voice is heard? Hey, most hams in this country won't even answer a call on a repeater from another adult. The sound of a young voice must cause paralysis. Again, don't take my word for it. Next time you're in an area where nobody knows your callsign, pass the mike over to a young person and have them use your callsign to announce that they are monitoring. Nine times out of ten you'll hear silence, even on the most populated repeater in the area.

Hey, it's not only kids who get snubbed as newcomers at club meetings and on repeaters. I've sat through entire club meetings where not one person has asked me my name or whether or not I was a ham. Nothing! And yet, if you ask everyone at that meeting what the single biggest problem facing amateur radio is, you will probably get a unanimous response: growth. We can talk all we want about increasing the number of hams, but the evidence shows that we don't want any more hams.

Hell, the editor of another ham magazine recently admitted that he wasn't thrilled when his neighbor expressed an interest in becoming a ham. He asked his readers to tell him why he wasn't thrilled at the opportunity to share this great hobby with a neighbor. I'll tell him why. Could it be that he doesn't want any new hams living on his block, causing TVI, calling him up to ask for advice, borrowing his old equipment and having the fun that he's been having? God forbid, this neighbor might have a few grandchildren, or perhaps he works with the Boy Scouts or some other youth organization. What if this neighbor got his ticket and decided he was going to become an elmer for (gasp!) kids?

Ya' know. . .I'm a pretty tolerant guy. There are few things in this world that can get me really steamed. Most of them revolve around bigotry and dishonesty in all their various forms. That is why I am sick and tired of the amateur community giving lip service to increasing our ranks. It's a boldfaced lie, folks, and it's about time we stopped telling it to each other.

If we keep talking about getting more people—kids and adults—interested in amateur radio, why is it that we mostly do everything possible to keep people away? Until we come to grips with this elitist, bigoted attitude, any discussion of *how* to interest others in amateur radio is pointless.

Last month I suggested that with all the other high-tech marvels competing for a young person's attention, perhaps amateur radio was considered old news. What was magic to me as a twelve-year-old in the pre-computer era is low-tech to today's twelve-year-old computer hacker. But maybe the problem isn't getting the magic back into amateur radio. Maybe the problem is getting the magic back into radio amateurs.

Getting The Magic Back

Last month I asked you if you remembered the excitement you felt when you made your first QSO. For most of us, it was probably a CW contact on the Novice portion of one of the lower bands. Do you remember your first DX QSO? Was there someone there to help you get your ticket? Did someone hold your hand and walk you through what was then a strange, wonderful and frightening new world?

Amateur radio can be just as strange, just as wonderful, and just as frightening to a newcomer in 1991 as it was to you in 1940 (or 1950, or 1960, or 1970). Young or old, the excitement of that first QSO can be every bit as magic to a new Novice using a TS-440 as it was to you on an HW-16.

Have you lost that feeling of magic? Has ham radio become boring for you? Are you spending less and less time behind the rig and more and more time in front of the TV? Maybe you need to find that magic again, too. The best way to re-spark your own interest is to share it with someone. Pick out a few young people and share amateur radio with them. Make it fun. Build some antennas, put together a QRP rig or drag out that old boat anchor. Take a few youngsters on a mountaintopping expedition or camping trip. The next time your neighbor is standing on his lawn and staring up at your antenna, invite him in to see what's at the other end of that tribander.

If your radio club meetings are something you force yourself to attend, instead of the highlight of your month, find one other person who agrees with you and stage a coupe. Throw out the old men and invite the local Girl Scout troop to a meeting (that oughta' shake 'em up).

Plan a hands-on demo booth at your local mall. Yes. . .Hands-on! Let visitors to the booth actually sit behind the microphone and make a contact. Make sure to have RTTY for the shy folks. Don't forget a packet demonstration. Go out and actually solicit new hams. Are you retired? How about setting your station up at a local elementary school? All you have to do is ask. Talk to a science teacher and volunteer to demonstrate packet via satellite. Any teacher worth her tenure will jump at the chance to demonstrate what they're teaching.

If the magic has gone out of amateur radio for you, you can't blame anyone but yourself. Amateur radio is just as exciting as it ever was. You've just got to find someone to share it with. 73

Number 32 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

January 1991 is not expected to be a stellar month for DX, with less than half of the days ranking only good or good-to-fair (see the calendar). Seven days will be downright poor, with the remainder trending poor-to-fair or fair-to-poor. Many alignments are taking place this month that will keep the ionosphere disturbed, and the magnetic field unsettled to active. Solar flux may be trending downward during part of the month as well, which won't help matters a lot. However, watch WWV carefully for trends on an hourly or daily basis for an upwardly moving solar flux and a downwardly moving "A" index. Let's hope February will be better.

The 80/75 and 40/30 meter bands should provide some good, low-noise activity in the U.S., Canada, and South/Central America, but DX will depend on a relatively quiet magnetic field. On the poor days, however, don't despair, since trans-equatorial skip and over-the-poles signals will be present. The polar paths will be weak and full of echoes, whereas the trans-equatorial path will provide stronger signals, sometimes even on poor days.

The 160 meter band ought to be good for much of the month, so watch the calendar for the good and fair days. The 20/18 meter and 15/12 meter bands will suffer the most along with 10 meters this month, so don't expect miracles. Perhaps in February we'll see some improvement, and March ought to get us back on the road to good worldwide DX conditions on all bands. Let's wait and see. . .de W1XU 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	20	20	–	20	20	–	[illegible]	–	15
ARGENTINA	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	–	[illegible]	[illegible]	[illegible]	15
AUSTRALIA	[illegible]	[illegible]	–	–	20	40	20	20	[illegible]	–	20	[illegible]
CANAL ZONE	15	20	20	30	–	40	–	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	40	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	[illegible]	15	20	40
HAWAII	[illegible]	20	20	20	20	40	40	–	[illegible]	–	–	[illegible]
INDIA	–	20	20	–	–	–	20	15	–	–	–	–
JAPAN	15	20	–	20	20	–	20	20	–	10	–	15
MEXICO	15	20	20	30	–	40	–	10	10	10	10	10
PHILIPPINES	15	–	–	–	–	–	20	20	[illegible]	–	–	–
PUERTO RICO	15	20	20	30	–	40	–	10	10	10	10	10
SOUTH AFRICA	20	40	–	–	–	–	–	–	10	10	[illegible]	20
U S S R	–	–	–	–	–	–	[illegible]	[illegible]	[illegible]	–	–	–
WEST COAST	[illegible]	[illegible]	15	40	40	10	–	–	[illegible]	10	10	10

CENTRAL UNITED STATES TO:

ALASKA	[illegible]	[illegible]	–	–	20	–	–	20	–	–	–	–
ARGENTINA	20	20	20	20	20	–	–	–	–	10	[illegible]	[illegible]
AUSTRALIA	[illegible]	–	–	–	–	40	40	20	[illegible]	15	15	15
CANAL ZONE	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
ENGLAND	40	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]	[illegible]	20
HAWAII	[illegible]	20	20	20	[illegible]	[illegible]	40	20	–	15	–	[illegible]
INDIA	20	15	20	–	–	–	20	20	–	–	–	–
JAPAN	[illegible]	[illegible]	–	–	20	–	–	20	–	–	–	–
MEXICO	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
PHILIPPINES	15	[illegible]	–	–	–	–	–	–	20	20	–	–
PUERTO RICO	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
SOUTH AFRICA	20	[illegible]	–	–	–	–	–	–	10	[illegible]	15	15
U S S R	–	40	40	20	20	–	–	15	10	20	–	–

WESTERN UNITED STATES TO:

ALASKA	[illegible]	[illegible]	–	–	–	–	10	40	–	–	20	[illegible]
ARGENTINA	10	15	20	[illegible]	[illegible]	20	–	–	–	15	10	10
AUSTRALIA	10	20	20	–	–	–	40	–	–	15	–	–
CANAL ZONE	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	10	10	15
ENGLAND	–	–	–	40	40	20	–	–	[illegible]	[illegible]	20	20
HAWAII	15	[illegible]	[illegible]	20	–	40	40	–	–	15	10	10
INDIA	–	[illegible]	20	–	–	–	–	–	20	–	–	–
JAPAN	[illegible]	[illegible]	–	–	–	–	40	40	–	–	20	[illegible]
MEXICO	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	15	15	15
PHILIPPINES	15	15	–	–	–	–	–	–	20	20	20	15
PUERTO RICO	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	15	15	15
SOUTH AFRICA	20	20	20	–	–	–	–	–	–	[illegible]	[illegible]	15
U S S R	–	–	–	40	20	20	–	–	15	20	–	–
EAST COAST	[illegible]	–	15	40	40	40	–	–	[illegible]	[illegible]	–	–

JANUARY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
		1 P–F	2 F–G	3 G	4 G	5 G
6 G	7 G	8 G	9 G–F	10 F	11 F	12 F
13 F	14 F	15 F	16 F–P	17 P	18 P	19 P–F
20 F	21 F	22 F–G	23 G–F	24 F	25 F	26 F
27 F–P	28 P	29 P	30 P	31 P		

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LETTERS

From the Hamshack

Laci W1PL, Melrose MA Wayne, it was great to meet you and even more so to hear you talking to the New England DX people about the problems, the negative effects of the pursuit of the ARRL DXCC as it happens today. This problem bothered me also for a long time, discussed it with a few close friends, but we felt incapable and utterly powerless to even try to do anything about it.

You have proven so often that you see the future of amateur radio way ahead of the rest of us. It seems to me, the DXCC problems must be solved in some reasonable manner to keep it desirable, obtainable, and alive at all.

I know it is very difficult to change anything, but it could be done, I think, if valid DXCC credits would be given for QSOs worked only during the world's main contests, CQWW, ARRL DX, WAE, and AA. This would increase participation in the contests, concentrate the DXpeditions in those time frames, and would eliminate the discouraging, alienating effect of so many pileups with all the annoyances. The general ham population would enjoy operating in a more quiet atmosphere (ionosphere?). Even the rare DX stations would be free of that aggressive calling-hysteria, which chases the rare DX operator off the bands.

Immediately after the war, when I was practically the only HA station on the air, I lived quite a few years under the pressures of a rare DX. It was a bit easier than today, due to the lower powers, fewer beam antennas, and (may I say so?) snappier operators and more gentlemen. It still was often too much to take.

I leave my idea now with you, and please continue working for amateur radio's better future.

Thanks for your nice letter. I was wondering what impact my talk might have on the DXCC brethren. I had to get back, so I didn't hang around to see whether they would arrange a monument or tar and feathers.

One added benefit, as you mentioned... contest contacts would eliminate most of the QSL problems since they'd all be handled by computer.

Laci, I've changed amateur radio a good deal, so maybe I can do some more. I'm trying.

If I remember well, our first OSO happened 43 years ago! Hi!... Wayne

Kent Phillips WB8HWO, New York NY Wanted you to know *73* has followed me everywhere in the Middle East, and without your refreshing comments life would be rather dull. Keep up the satire only worthy of "Uncle Wayne." Please enter me in Ham-It-Up Sweepstakes; I'm only 6,000 miles from my nearest dealer.

Steve Katz WB2WIK/6, Canoga Park CA I've been following your "Never Say Die" editorials for years, and have also been reading the "Letters" section of *73*, which are far more interesting than the same section in competing magazines, for two reasons: One, the letters appear to be printed in full: and two, they often contain replies.

Actually I've been a Green fan ever since you were my first New Hampshire contact on 2 meter AM back in 1966 when I was a new Novice in New Jersey running a Heath "Twoer." To make a contact with NH using about 1.5W output to a little 8-element yagi—a 250-mile path over hilly terrain using terrible equipment on my end—was such a staggering accomplishment that it turned me on to VHF/UHF for life. I believe on your end, you were running high power and an enormous collinear antenna part way up Mt. Monadnock. You used to generate pileups among us "lowland leaf-lookers" in NJ and PA.

In the December *73* "Random Output" by David Cassidy, Dave recalls the magic of wireless communications and how the newcomers to the hobby might miss out on the feeling. I agree. It's sad that most new hams are such appliance operators; they never think about what goes on inside their equipment to make easy QSOs possible. Anybody who hasn't home-brewed at least one complete setup, or at least a simple transmitter, doesn't know what he's missing.

Over the past 25 years, I've upgraded to Extra (I love CW, anyway; color me crazy) and home-brewed dozens of stations, sometimes including complete receivers (what a job!) and often of my own design, good or bad. All my kW amplifiers are home-brewed, except for one Henry Radio RF deck using a 3CX1200D7, and I built the power supply for that. Now, living in a townhouse in Los Angeles, after owning several homes on large lots back East, I enjoy the challenge of working DX using small antennas, or going hill-topping to work VHF DX. There are always a million challenges! To sit in front of one's store-bought transceiver for hours on end cannot be anybody's idea of a thrill... can it?

I agree with you, we need more young blood in amateur radio. It does seem that most of my CW contacts are with retired folks who learned the code before or during WWII. Even the world-class contesters, presumably the best operators in the world, are getting older. Who will replace them, to set new standards? Who is going to be the first to make 300 QSOs/hour in a contest? Work DXCC in 60 minutes? Develop systems to make packet meteor scatter contacts a daily occurrence? Keep pushing for less restrictive legislation regarding antenna and tower zoning and ordinances? Design the new amateur equipment? Distribute and sell it?

There's far fewer ham stores in America than ever in my personal tenure. I don't see how any of them make it. I'm lucky enough to be within a one-hour's drive on crowded freeways to not just one or two, but *five* amateur radio outlets. This may exist only in Los Angeles. Used to be, New York City alone had a dozen—but I believe only Barry remains. And do the "locals" support their local dealers? Not by a long shot! Most folks around here would rather mail-order their gear to save the sales tax. Big deal! They probably save $35 on a $1,000 purchase when the shipping costs are added in.

Then, the average ham is looked upon as a weirdo by the rest of society, anyway. Many are socially inept, severely introverted (except on the air). Some are bona fide sociopaths! (Just listen in on a couple of the wide-coverage L.A.-area repeaters.)

What can we do to generate interest among the youngsters, who might be able to save ham radio? For starters, we can get our own kids interested and licensed. Every licensed amateur who is a school teacher at any level should introduce the wonders of wireless communication to his or her students—maybe even convince the board to make ham radio an accredited class. Every active ham who is a radio club member should bring one non-ham to the next club meeting, and make the effort to introduce that person to the gang. Make an issue of it, with formal introductions and the rolling out of a great, big welcome mat. We have a great hobby for retirees, but licensing the old-timers will not help the service survive. Only the kids can do that.

Every time I have a youngster in my car, for any reason, I don't ignore the two transceivers installed therein. I pick up the mike and make a few contacts, explaining to the visitor what's going on and how much fun it is. Their eyes open wide as they hear the foreign accents rolling in on my 10 meter rig, and get wider when they hear an Aussie or Slav respond to my call. "How's the weather there in Belgrade, old man? Do you do any skiing on all that snow?" "Do you guys in Sydney really use boomerangs to get your dipoles up in the trees?" Make it interesting! The kids are guaranteed to go nuts, asking questions about how to get licensed.

I show my limited DX OSL card collection (about 100 countries are hanging on the wall—the most interesting cards I could pick out from my collections, with bright colors and bold descriptions of the DX locations) to practically every single visitor to our home. Since everybody here in California is from someplace else (or so it seems!), I ask each new acquaintance where they're from, and try to show them one QSL card from that place, stating proudly, "Oh, yeah, I know this guy Sam from there. He's an avid fisherman, and pulls the big trout out of Lake Whatchamacallit." They are absolutely dumbfounded. Maybe one in five will ask some questions about ham radio... then they're hooked.

My eight-year-old nephew, better traveled than most because he was born in the Middle East, lives with us. He's probably the only third-grader in his school who actually knows where all the DXCC countries are, along with the names of countries no longer in existence, and what's taken their places. With mildly incapacitating cerebral palsy, his coordination is not great, but he can copy 5 wpm and get most of it down on paper. A Novice ticket can't be more than a year away—probably closer—for him. He's the only eight-year-old I know who can answer nearly all the "World Geography" questions on Jeopardy! He's also getting a grasp of simple algebra, which won't be taught in his school for another two years, based on his interest in Ohm's Law.

There are as many ways to get youngsters interested in radio as there are youngsters. One only needs to take a bit of time to find the right button to push. I compel anyone interested in the future of amateur radio to look for those buttons, push them, and keep on pushing until all the neighborhood kids have their tickets.

I know you're not just trying to sell more magazines, Wayne. There are lots of easier ways to make money. If the hobby were healthier, really booming, *73* could be free, paid for entirely by advertising revenues. Keep up the battle. Some really are listening. And thanks for being my first 2 meter DX contact, 25 years ago. I still remember.

Thanks for taking the time to write such a great letter. I wish more hams would do that! I'll be publishing it... hoping that maybe you can get some of these tired old geezers off their butts.

Good news: I'm getting closer to getting NH to set up my electronics education course. This could turn out 10,000 hams a year. Just from NH!... Wayne

Trevor M. Artingstoll G0JOE, UK So Ole Ozzie KA1BIK is the other guy left on the planet with radio dust infection? I suggest we manufacture the drug and peddle it in schools and institutions of higher learning. I'd pay $100 for an inhaler packet with the stuff, myself. Imagine, in a dull moment, unscrewing the little plastic cap, inserting the tube delicately into the waiting nostril, and—kepow!—back to the Land of Glowing Bottles—searching in the coal box for gold streaks to stick in a crystal set—wrecking basket coils for the hell of it—soldering real, honest-to-God, *solid* copper wire seductively wrapped in cotton—drilling ebony wood front panels—! But I speak a foreign language to young and middle-aged hams. Sigh! There's no cure, you know.

David Terrell KB5LAM/AA Thanks for producing a high-quality product. I weighed *73, CQ, QST*, and *World Radio* in the balance. *73* has the best mix of the things I want to see. I devour the technical issues and construction articles. I also enjoy the human side about clubs and individuals. I've requested the writing quidelines you've established and intend on trying my hand in both areas.

Lowell E. Robertson K6QXQ, Riverside CA I am rather slow at responding to the article, "Rad Radiator," in the May 1990 issue of *73*. I just want to comment that the wire hanging down from the bottom of the walkie-talkie creates a variation of the "counterpoise" antenna which may be a long forgotten antenna type. This may sound critical of an otherwise well-written article, but the term "counterpoise" has a more professional ring than "rad radiator."

Richard Ernst /EA7, FPO NY Three months ago I purchased the new *1990 ARRL Handbook* at the cover price of $23. Table 42 on pages 35–38, and 39 contains the "ARRL Parts Supply List." Being an avid home-brewer of just about everything, and being posted overseas, I said to myself, "Rich, here is your source of mail-order parts." I sent 12 letters to companies on this ARRL list, and as of today I have yet to receive the first reply. After 26 years I guess I haven't learned my lesson yet. Caveat ??

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DEPARTMENTS

FEEDBACK... FEEDBACK!
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.

FB

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Audit Bureau of Circulations (ABC) membership applied for.

Contract: See where natural ham curiosity gets you? Upon finishing reading the first sentence, you have formally contracted with *73 Amateur Radio Today* to be our grass-roots ad sales person. Recognizing that we give you more ham fun for the buck than the rest, it should be a cinch to make this clear to every dealer and manufacturer you contact to exhort them to advertise with us. Remember: More ad pages = more articles. So where does ham curiosity lead to?—more great home-brew for you!

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Scrambled Brains

Some years ago in one of my usual feeble attempts at humor I suggested that since we seemed to have far more bad operating problems with our Extra Class hams than with others, maybe the Morse code had scrambled their brains. One advertiser, with a sense of humor down in the molecular range, canceled all his ads in *73* in retaliation. Well, that means you readers have been out about five good construction projects a year that these ads would have made it possible for us to publish, and the advertiser has thrown away around $200,000 a year in sales. I have to admire such strong convictions, no matter how misplaced.

I know you're hoping I'll digress with more irrelevancies, but no, I'm going to get back to the subject at head. Okay, for those few readers who are borderline illiterate . . . in other words, who do not subscribe to *The New Yorker* magazine . . . I've some news. Paul Brodeur, the chap who wrote a three-part series in the same magazine last year about the effects of weak electromagnetic (EM) forces on cells, has been at it again. Look for his book, *Currents Of Death*.

ARRL stalwarts who bothered to attend the 1989 League convention had the opportunity to hear Dr. Ross Adey K6UI give a remarkable talk on the subject. I recently watched a video tape of his address . . . something every ham club should put on their program. My tape came from WA6PMX. Ross is one of the leading scientists working in this field . . . another feather in the cap of amateur radio.

The latest Brodeur *New Yorker* article picks up from where he left off the year before. It turns out that not only do incredibly weak EM forces have very measurable effects on cell growth and communications, this is exacerbated when there are switching transients involved. Square waves.

The human statistics back up scientific experiments with mice and chicks. Women who use electric blankets are having a greatly increased incidence of miscarriages and malformed children. There's a strong link to cancer, too. My first solution to this was to suggest rectifying the current and making it DC. Nope, as long as you have those infernal thermostats turning the DC on and off all night, you're hitting your whole body with square waves. Bad news.

Brodeur reported on the incredible incidence of brain tumors across the street from a power substation in Connecticut . . . and the high incidence of tumors among power company workers. We see a similar higher than normal incidence of cancers with hams. Ross pointed out in his talk how the League flatly refused to cooperate with research aiming at getting this information.

This opens up some very serious questions for us. First, there is a need for you to make sure that you elect a new director, one who will force the League to cooperate with researchers in studying such matters. I can understand why the League has a vested interest in trying to cover this up. This is the same route taken by the tobacco industry when it was suggested that cigarettes might be harmful. That industry still isn't convinced.

But let's suppose that the obvious is actually true . . . that the powerful square wave EM field our transmitter generates when we send Morse code does affect the cells of our bodies and brains to some degree. Our systems do a heroic job of repairing damage done by carcinogenic materials we eat and breathe. But can we really expect this repair system to be able to cope 100% with powerful and extended daily blasts of EM energy which screw up cell growth and communications in our brains and every part of our bodies? I'll be surprised if we don't find that dedicated CW operators . . . particularly those running some power . . . aren't dying far faster than our actuarial tables predict. Our beloved, worshipped Morse code could well be killing us.

Even More Bad News

Okay, we can see where we might be in trouble when we're transmitting, but at least we can receive code without worrying, right? Oh yeah? When you're receiving Morse at 20 per, that's at about 6.4 Hz. You're blasting your brain with a 6.4 Hz set of square waves. We've isolated several of the operating frequencies of the brain and they're all in the low Hz range.

Is it really just a coincidence that such a heavy proportion of the troubles we've been having in amateur radio seem to be with Extra Class operators? Is it entirely a coincidence that almost none of the Bash-licensed Extras are in trouble? We know that a high percentage of the Bashers never had to bother learning the code.

The personality changes which the code may be making in us would occur slowly, over a period of years, so families and friends would come to accept them, no matter how bizarre they are. Wives somehow manage to get used to DXers putting a new country before the marriage, children or even making a living.

Ham dealers joke about hams being crazy. Do we become hams because we're crazy or vice versa? No, I agree, not all hams are crazy. I don't think I am, but you know I'm not going to ask for a second opinion. Is it mainly Extras and their 20 wpm code? How much of an effect can 13 per have? Maybe we can accept amateur radio only partially addling our brains.

I know this, I'm keeping my linear amplifier far enough away from my operating position so I'm not going to be milligaussed and square-waved. I'm going to steer well clear of Morse, both receiving and transmitting. I suspect that frequency-shift keying may be far more benign.

You may be sure that I'm going to keep HTs with subaudible tone generators far away from my body. Ross has published some frightful charts in scientific journals showing what a 450 MHz HT with a 16 Hz tone can do to cells.

An Opportunity

As the media begins to understand the extent of the damage being done to people by electromagnetic radiation, I'll be surprised if they don't jump on this gloom and doom bandwagon and scare the public silly. This should open an opportunity for entrepreneurs to offer degaussing services.

You can build or buy a milligaussmeter pretty reasonably. As the demand goes into panic mode, we'll go through the usual shortage/glut roller coaster ride. With a meter and some understanding of EM, entrepreneurs should be able to set up some very profitable businesses.

If you think old Uncle Wayne is pulling your leg, check out *Time*, July 30th, page 53. I do my homework before I write, even when it means wading through a pile of heavy duty research journal reports. I'll put the bibliography on the *73* BBS, if you'd like to check it out.

From what I've read so far it seems very likely that further research could show that CW ops running a couple hundred watts are getting a carcinogenic blast of EM which is equivalent to smoking a pack or two of cigarettes a day. This stuff is insidious, like cigarettes. It won't kill you in a day or a week, but slowly, over a period of years, it may be changing your personality (not likely for the better) and shortening your life. I feel tremendously lucky that I changed to frequency-shift keying 40 years ago.

The Bottom Line

So it looks as if Sam Morse didn't do us any favors. The code not only has little place in modern radio communications, it may well be damaging our minds and bodies and sending us to an early grave.

As Ross pointed out, anyone who says this is controversial is ignoring incontrovertible facts. But I can understand an urge to dismiss bad news. There must be some mistake. Our government wouldn't let us use electric blankets if they were dangerous, right? Sure, like they don't let us drink alcohol and they don't let us smoke. When the dollars involved are big enough, Congress will go along with the money, no matter how many people get killed.

Our Cells

If you do some homework you'll find that our cells work on a combination of electrical and chemical reactions. They are busy working and duplicating themselves, all as part of a cooperating group. They communicate electrically, using low Hz frequencies. The duplication process involves the magnetic transfer of information as DNA molecules copy and split. Part of this is chemical, part electrical, and part is magnetic.

We can interfere with this process with drugs and interfering magnetic fields, but the body only has so much ability for self-repair and when eventually we exceed that the cells go berserk. Cancer. Tumors. Miscarriages. Deformed children. Children with damaged genes which may not kick in until years later. We'll know more about those effects as the Genome Project progresses.

If you think Wayne is full of baloney on this one, do me a favor. Go back through my 40 years of editorials and show me where I have ever been wrong on a scientific matter.

Flaplet

If you don't read the ARRL HQ BBS you missed a great item telling how angry a couple of ARRL officials were at the recent Houston Ham Com. They were mad because their ARRL booth for selling *QST* subscriptions and League books wasn't allowed free into the paid vendor area. They were further steamed when they were refused

Continued on page 73

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

No Code At Last!

On December 13, 1990 the first no-code amateur radio operator's license in the U.S. was approved by FCC Bureau Chief Haller and Commissioners Cross, Quello, Duggen, and Sykes. Docket 90-55 establishes a codeless license by eliminating the code requirement for the Technician class license. This is the first no-code license in the history of the U.S. Amateur Radio Service.

Applicants for the new Technician license will have to take the theory exams, a total of 55 questions, required for both the Novice and Technician class licenses. The new Technician will be granted all privileges on all frequency bands currently allowed to Technician class license holders, but only for operation above 30 MHz (6 meters and above).

For existing Technician class license holders, nothing changes. Technicians licensed before the implementation of the new codeless license will be grandfathered to protect their earned HF operating privileges, including 10 meter radiotelephone. The Novice class is also unaffected by this change.

The new Technician will be able to experiment with exotic modes, own repeaters and remote base stations, but not participate in HF operation unless HF privileges are gained by passing the 5 wpm Morse code test through the VEC system.

Originally, the FCC had proposed the phasing out of both the Novice and Technician classes, claiming widespread cheating in Novice testing and a general need to save money. The ARRL said the abolition of both classes was unacceptable, and several VECs offered to bring Novice testing, at no cost, under the VEC system. At FCC conventions, the media demanded proof of the cheating claim, which the FCC failed to provide. Also, individuals and groups presented the FCC with information that refuted their budget-saving argument.

In the end, the FCC opted to follow the suggestions of the Quarter Century Wireless Association (QCWA). They retained both license classes and modified the requirements for a Technician class license to create a code-free entry into amateur radio. Many of us hope that this will increase the growth of amateur radio without decreasing the quality. Says Bureau Chief Haller, "Morse code does not prove what kind of operator you are going to be. It only proves that you can send and receive Morse code! We [the FCC] are retaining a written test. There is a license that can be lost for. . . violation of the rules. . . ."

All five FCC commissioners agreed that passing Docket 90-55 will keep the nation at the forefront of communications research and development, and help recruit technically inclined people into the Amateur Radio Service.

There will not be any call-letter distinctions between the old and the new Technicians. It will still be up to the amateur community to police its own ranks.

Most experts feel that full implementation could take place as early as February 1, 1991. *TNX Bill Pasternak WA6ITF of Westradio and Amateur Radio Newsline, and Paul Courson WA3VJB, Washington correspondent.*

Docket 90-356

The above FCC commissioners also passed Docket 90-356, the CW waiver for certain handicapped individuals. Passage of this docket exempts handicapped persons from the high-speed code exams if their physical condition makes it impossible for them to learn code at the required speeds. Commissioner William Cross says that the FCC "will rely on a physician's certification of disability to determine eligibility of an applicant."

Private Radio Bureau Chief Ralph Haller W4RH said that relaxing code requirements for the handicapped, along with establishing the new codeless Technician license, will promote further growth of amateur radio. During the presentation, Chief Haller held up a 2 meter HT and declared it a symbol of the vital role amateur radio plays. He said that because of amateur radio operators volunteering their time and personal funds, ". . . it is possible to communicate essentially around the world with a small radio like this! It gives you an idea of the dedication of these amateurs to the advancement of the radio art."

Commissioner Quello stated his personal feeling that it was definitely time to open the gates of amateur radio to those who may not be able to master the Morse code. He noted that today, "Most [communication] is by voice, anyway."

Commissioner Irvil Duggen said, "There was some fear in my mind [at first], that we might be leaning over too far backwards in relaxing our standards, and that in trying [to be] compassionate and responsive to the special needs of handicapped people, we would in fact rob them of the pride that they might otherwise have in being able to meet tough standards. . ." But the hundreds of comments the FCC received from people and groups "removed that concern."

Chairman Sykes said that "The steps we took to broaden [the Amateur Radio Service]. . . holds the potential to provide an even more vital and dynamic service."

All five commissioners voted unanimously on both agenda items: Approving CW waivers for handicapped hams who want to upgrade, and dropping the CW requirement for the Technician class license. *TNX Bill Pasternak WA6ITF of Westradio and Amateur Radio Newsline, and Paul Courson WA3VJB, Washington correspondent.*

The ARRL's Response

Subject: ARRL No-Code Reconsideration. The ARRL applauds retention of the Novice license and seeks input on privileges for codeless technicians.

Responding to the Federal Communications Commission action PR Docket 90-55, creating a codeless class of amateur radio license, the president of the American Radio Relay League, Larry Price W4RA, noted with pleasure that the Commission had decided to retain the Novice license as a means of entry into amateur radio and to adopt a codeless license with a meaningful written examination requirement. "Our members were very strong on both of these points, because they couldn't imagine how we could maintain the character of the Amateur Radio Service without them," Mr. Price said.

However, President Price sounded a note of caution with regard to the privileges the Commission plans to grant to the codeless licensees. "The formula developed by the ARRL Board of Directors, which called for privileges above 220 MHz, was based on extensive membership input. It was carefully balanced to offer attractive privileges while protecting existing patterns of amateur activity."

While it will take some time to gauge the reaction to the Commission action, Dr. Price observed that the FCC formula is likely to be less acceptable to many amateurs than the League's. He asked that League members share their views with their elected directors, who collectively determine League policy.

"Before we can decide whether to request that the Commission partially reconsider its action, we'll have to see the Report and Order," said Mr. Price. Usually it takes the FCC from several days to several weeks after a Commission action to release an item after editorial review. There is a 30-day window of opportunity following release in which petitions for reconsideration can be filed. Mr. Price noted that the ARRL Board is holding its regular meeting January 18–19. "The timing looks good for a careful review of the Commission's action at that meeting," he said.

For further Information contact: David Sumner K1ZZ, tel: 203-666-1541; Fax: 203-665-7531. *TNX Bill Pasternak for sending us this Amateur Radio News Release from the American Radio Relay League, Inc., via MCImail on Dec. 19, 1990.*

QRX . . .

Persian Gulf Rands

Nearly 400,000 U.S. troops in the Persian Gulf means increased military communications on the HF bands. Here are some USAF Global Command and Control System (GCCS) frequencies in kHz, USB:

•Loring AFB, ME: 3074, 6738, 8964, 11179, 13214.

•MacDill AFB, FL: 4746, 6750, 8993, 11246, 11288, 13244, 18019.

•Ascension Island: 6750, 8993, 11176, 13244, 15015.

•Croydon, UK: 3067, 5703, 6750, 9011, 11176, 13214.

•Incirlik, Turkey: 3137, 6738, 11176, 13214, 15015, 23227.

The Saudi Air Force can be heard on 3095, 5526, 8967, and 8990. Dharan Air Base has been heard on 9130 and 11100, using the callsign "Hotel 1"; Riyadh "Hotel 2" is on 7300 and 12112. The U.S. Army Corps of Engineers in Saudi Arabia are on 9130 and 11425, using callsigns "Castle 1" through "Castle 8". 11300 is another active frequency in the area. The United Nations forces are assigned the following sets of frequencies:

•Primary: 6632, 9006, 11233, 13231, 13257.

•Secondary: 4704, 5690, 6204, 6810, 6905.

Middle East air traffic controllers for the Gulf Region operate on: 2992, 3404, 5603, 5658, 5667, 8847, 8918, 10018, 13288, 13312, 13336. In the gulf and nearby waters, the U.S. Navy has been heard challenging commercial vessels. The most active channels have been 4125, 1413, 4419, 6218, 6519, 6521, 8291, 8294, 12492, 12435, 16587, 16590, 16593, 22105, 22124, 22127, 22130, and 22136. Also check out their HICOMM channels on 7525, 12215, and 23315.

And remember, don't CQ Kuwait. A QSO with a Kuwaiti amateur could cost him his life. *TNX* Nashua Area Radio Club Bulletin, *and Ed Brown KB1MZ in particular.*

SAREX Success!

Over 500 hams were able to communicate with Ron Parise WA4SIR during the recent STS-35 space shuttle mission. The robot packet experiment was a success with 238 stations worldwide completing two-way packet contacts. Several hundred more were at least heard by the shuttle. Quite a few voice contacts were made, primarily in Australia, South America, and South Africa. A number of scheduled voice contacts were made as well during the evening passes over the U.S. Twenty-eight school groups in the U.S. had a chance to talk with Ron, via a telephone bridge to the uplink sites, while he was over Australia and Brazil.

A QSL will be issued to those who send in any received packets from the shuttle (QRZ logs). Please include the date/time of the reception. This information will help determine all of the stations who made one-way connects up to the shuttle. Please send your receive buffer files to the ARRL, Attention: Rosalie White, 225 Main St., Newington CT 06111. It would help to send an additional copy directly on packet to SAREX @ W3IWI.MD.USA.NA (or via internet mail to: sarex@tomcat.gsfc.nasa.gov).

A complete wrap-up of the STS-35 mission along with news of the upcoming STS-37 mission will appear in the March issue of *73*. *TNX AMSAT and WB8ELK.*

Get Rich—

—beyond your wildest dreams! Or, at least make a few bucks for yourself or your club.

The staff of *73* tries to get to as many hamfests as we can, but there are plenty we miss. That's where you come in. We'll pay you (or your club) to run a *73* booth for us. It's easy. We'll send you everything you need. You staff the booth and take subscription orders, and we'll give you a cut for every order you take. That's cold, hard cash! Up front. At an average hamfest, you should make a couple of hundred. Not bad for a few hours' work—plus, you'll get the personal satisfaction of sharing *73* with your local ham friends. OK, forget about personal satisfaction—do it for the dough! Just call Donna DiRusso at (603) 525-4201. *From the staff.*

TNX . . .

. . . to all our contributors. You can reach us by phone at (603) 525-4201, or by mail at *73 Magazine*, Forest Rd., Hancock NH 03449; and by e-mail on CompuServe ppn 70310,775, MCI Mail "WGEPUB" and the *73* BBS at (603) 525-4438 (300-2400 bps), 8 data bits, no parity, one stop bit.

Boy Scouts from Troop 73, Springfield, and Troop 94, Hillside, New Jersey, participated in the 33rd annual Jamboree On the Air, or JOTA, last October, when thousands of hams opened their stations to scouts. Above, at the Watchung Reservation in Mountainside, New Jersey, Springfield Emergency Management Staff KB2KOQ, KB2KEC, WA2WUX, WA2QNZ, KB2KEC, and WA2BAT (not in photo) set up a temporary outdoor radio station using a Kenwood TS-430S and long-wire Windom antenna.

Radar Detector to Microwave Receiver Conversion

Listen on 10 GHz, cheap.

by Steve J. Noll WA6EJO

The abundance of so-called "police radar detectors" made me wonder if these devices might have a useful application for the amateur microwave experimenter. These self-contained receivers are designed to detect police speed-measuring radar energy around 10.525 GHz (also 24.125 GHz in K-band), just above the 10.0 GHz–10.5 GHz Amateur Radio Service allocation.

Although there are plenty of these devices on the market, many of them are expensive for experimenting with. However, C.O.M.B. Company had been selling the BEL XKR series detector for very reasonable prices. I just couldn't resist! (The C.O.M.B. Company is located at 1405 Xenium Lane N., PO Box 32, Minneapolis MN 55440-9176. Tel. 800-328-0609 or contact BEL-Tronics, 20 Center Dr., Orchard Park NY 14127. Tel. 716-662-0522.)

I opted for the BEL XKR-IX Micro-Eye model although any of the XKR series should be similar. The Micro-Eye is a dual-conversion superheterodyne X-band and K-band detector. Although this article applies specifically to this particular model, other modern detectors may be usable, too.

Inside the Micro-Eye

The Micro-Eye is housed in a 1.25" x 4.25" x 4.5" two-piece plastic case. Opening the case proved to be the most difficult part of the entire project! It's glued shut. Careful and persistent prying with a knife will separate the halves to reveal the high-quality electronics inside.

The detector's circuitry is divided between two printed circuit boards. One board contains the controller section of the detector (not used for this project). The other contains all of the RF circuitry and a horn antenna. These two boards conveniently plug together via a 6-pin connector. See Photos B and C.

The controller printed circuit board contains a couple of comparator ICs (MC3302 and LM393), an LM358 dual op amp, and a 78L05 voltage regulator. A custom controller chip appears in the center of the board. About 60 discrete components round out the circuitry.

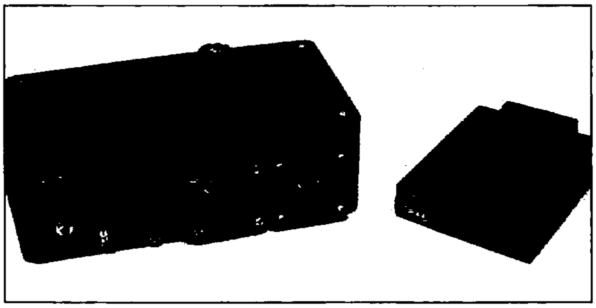

Photo A. The finished product (left) and the original radar detector (right).

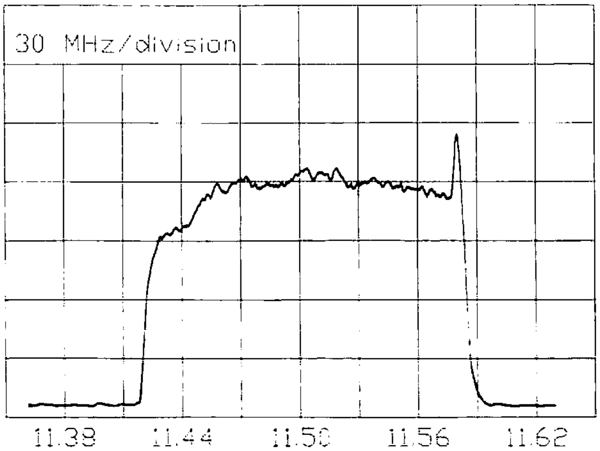

Figure 1. This plot shows the detector's VCO sweeping from 11.4 GHz to 11.6 GHz.

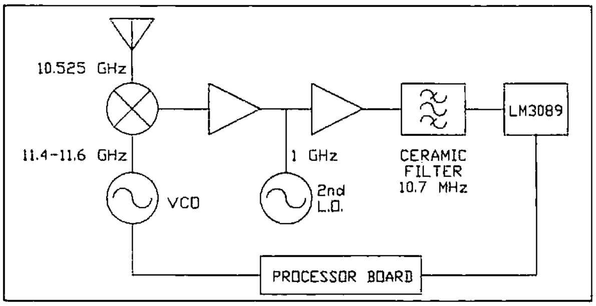

Figure 2. Block diagram of the radar detector.

Metalized, molded plastic covers most of the RF circuit board and forms three sides of the horn antenna. The circuit board itself serves as the fourth side. Some sections of the metalized plastic also provide shielding for the microwave circuitry. A dozen screws fasten the plastic cover to the circuit board. Photo B shows the detector's RF circuit board and metalized plastic horn.

Removing the cover reveals that the microwave circuitry is actually on a third daughterboard, previously hidden underneath (see Photo C). The tiny dimensions of the etched microstrip lines testify to the very high frequencies involved. There are two SOT packaged transistors and a mixer diode in a "beam-lead" package. The mixer diode is incredibly small—only about 0.01" square! Use great care when handling circuit boards with such minuscule devices.

How It Works (More or Less)

Of course, the radar detector instructions didn't include a schematic or theory of operation. Snooping, just plain guessing, and a spectrum analyzer helped me ascertain how this device worked, and whether it could be useful to the microwave experimenter.

Experience dictates that if this is a superheterodyne receiver, it may well radiate some of its local oscillator('s) energy. And sure enough, it does. I pointed a small X-band horn on the input of the spectrum analyzer (a Hewlett-Packard 8551B with a 8441A pre-selector) at the horn of the radar detector and picked up a weak signal sweeping between 11.4 GHz and 11.6 GHz (see Figure 1). The sweep rate was about 40 hertz, but it turns out that this was not the only local oscillator involved.

If this device is meant to receive signals around 10.525 GHz, then there may well be an IF between 11.4 GHz minus 10.525 GHz, and

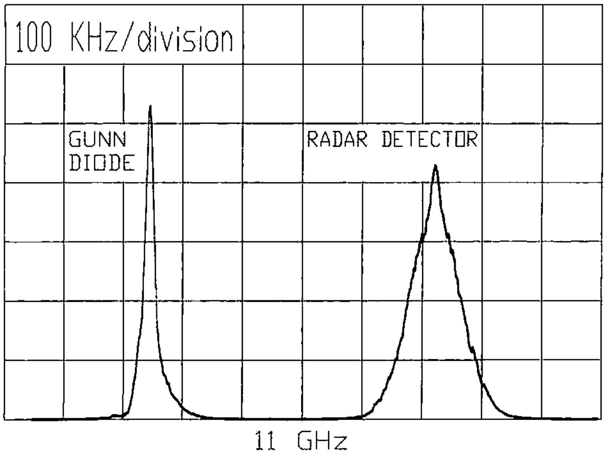

Figure 3. A comparison of the radar detector's VCO stability to that of a Gunn diode oscillator.

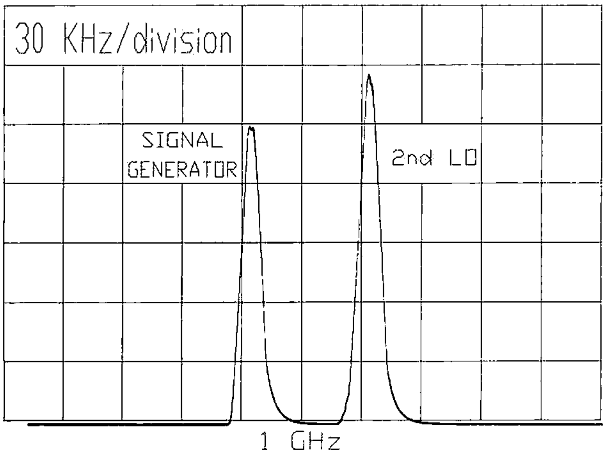

Figure 4. A comparison of the radar detector's second LO stability to that of a signal generator.

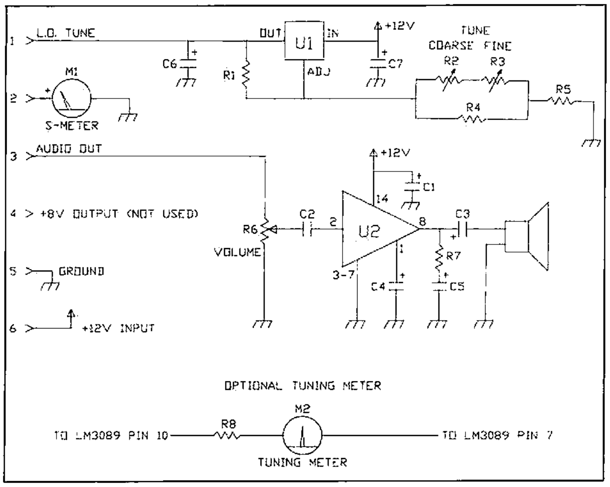

Figure 5. Schematic of the new circuit board.

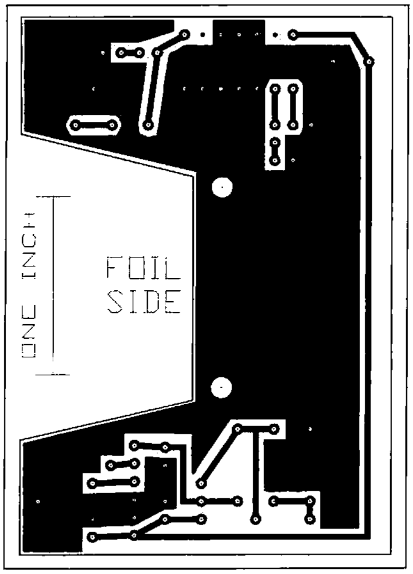

Figure 6. Foil side of the PCB.

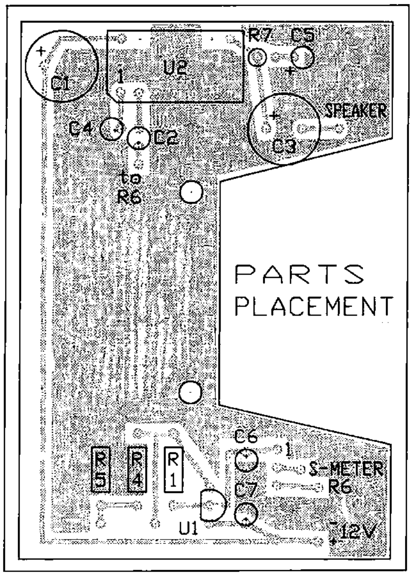

Figure 7. Parts layout.

11.6 GHz minus 10.525 GHz. "Sniffing" around the circuit board with the spectrum analyzer revealed a strong signal at about 1 GHz. This "second LO" signal was not swept in frequency.

Further examination revealed a welcome sight: a standard LM3089 FM Receiver IF System chip! Now here is something familiar with a 10.7 MHz input, an audio output, along with provisions for an S-meter and AFC. The input of the LM3089 is preceded by a 10.7 MHz ceramic filter which in turn is preceded by a couple of what appear to be microwave transistors. The first transistor amplifies the 1 GHz signal from the microwave circuit board and passes it on to the second transistor, which is also fed by the 1 GHz second LO, mixing the received signal down to 10.7 MHz (see Figure 2 and Photo C).

The 1 GHz second local oscillator is a TO-92 packaged transistor, while the first LO is comprised of the two SOT packaged transistors on the microwave daughterboard. This first LO, of course, is actually a VCO (Voltage Controlled Oscillator.)

Actually, the VCO probably generates RF at a lower frequency, the 11 GHz being harmonically generated in the mixer diode. With so many signals, and their possible mixes, it's hard to be sure even with the aid of a spectrum analyzer. The VCO/mixer diode combination also probably generates signals from 22.8 GHz to 23.2 GHz for the reception of K-band speed radars. The sweeping of the first LO frequency is probably done to make sure that any and all signals in the two radar bands are detected, and to make critical RF stage alignment unnecessary. A clever approach.

Modifying the Detector

The presence of the LM3089 FM IF chip hints that the radar detector might be easily adaptable to reception of Amateur Radio Service 10 GHz FM signals, such as those generated by M/A-Com Gunnplexers or Solfan transceivers. Two things still must be done: 1) Stop the first LO from sweeping and make it tunable. 2) Determine if the two LOs have sufficient purity and stability.

It turns out to be quite easy to accomplish the first item. The first LO is powered through one of the pins of the 6-pin connector that connects the RF and controller boards. If that pin is bent so that it doesn't mate with the connector, a variable bench supply can be hooked to it. In my unit, a 3.64 volt DC input made the VCO generate 11.5 GHz, while 5.9 volts yielded 11.0 GHz. The VCO drew only about 1 mA.

To check for purity, I observed the first LO signal on the spectrum analyzer side-by-side with a signal generated by a Gunn diode oscillator tuned a few kHz away. Although a Gunn diode signal might not be considered a paragon of purity, it does provide a valid guide, especially since the radar detector will be receiving Gunn diode signals in its new life. Figure 3 shows the result. The first LO signal on the right is much broader than the Gunn diode signal on the left. This is not good.

Note that the significant "pulling" effect of moving one's hand in front of a Gunn diode

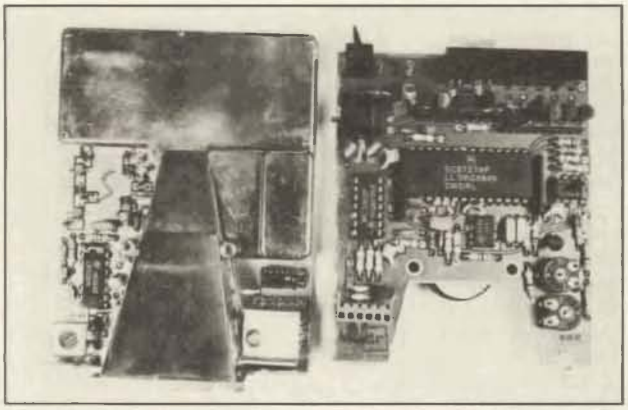

Photo B. Inside the radar detector. RF board on the left. Controller board (not used) on the right.

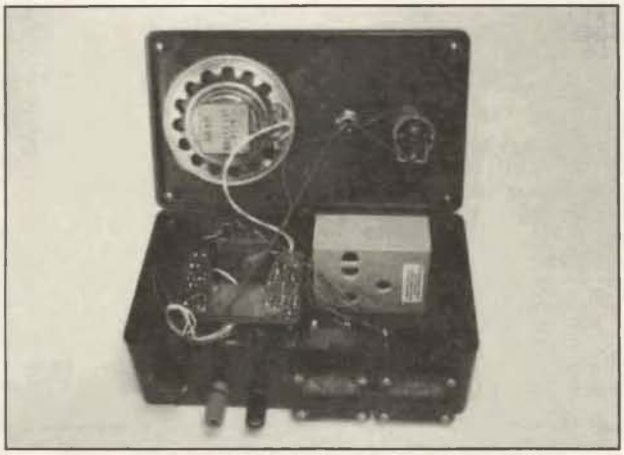

Photo E. The finished unit with the cover open.

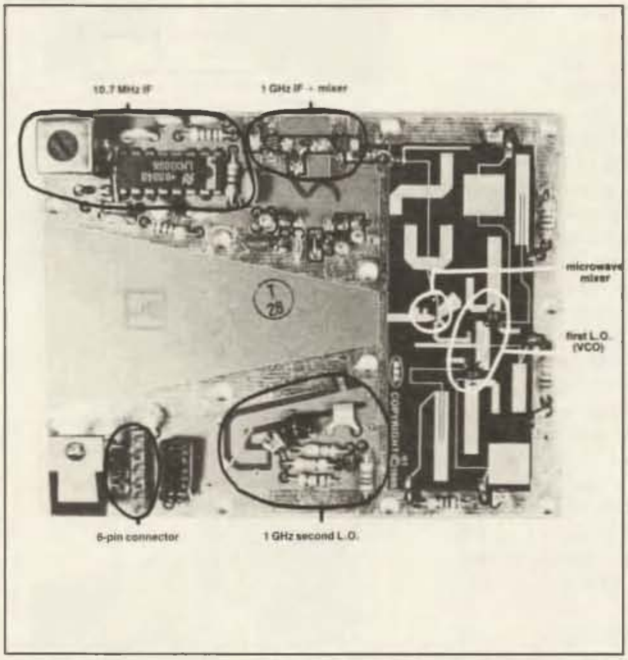

Photo C. A close-up of the RF circuit board after the plastic cover has been removed.

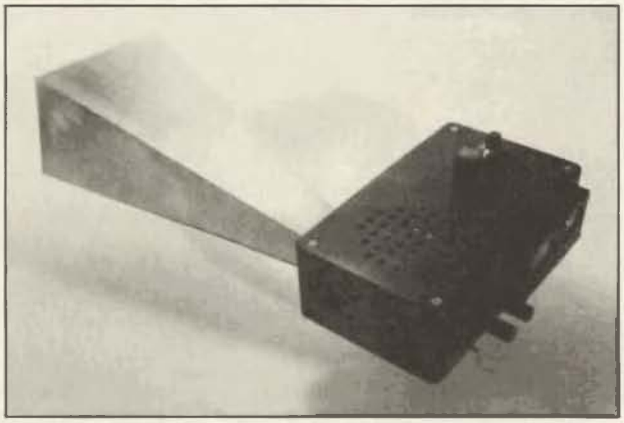

Photo F. The finished unit with the horn extension installed.

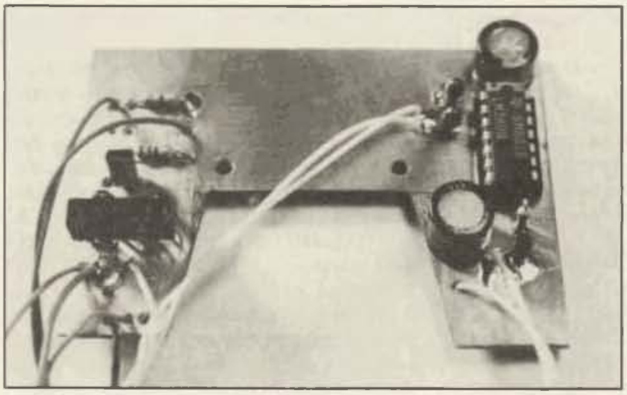

Photo D. The component side of the new printed circuit board.

transmitter horn is absent in the radar detector. The first L.O. is noisy, but reasonably stable.

The 1 GHz second LO signal is much more acceptable. In Figure 4, the 1 GHz LO signal (right) is identical to the signal from a TS-419/U signal generator (left).

At this point we know that the radar detector can receive FM signals due to the presence of the LM3089 IC. Also, it can be tuned to receive in the amateur portion of X-band by powering the VCO used as the first LO with a variable power supply. The question remaining is whether the first LO signal is good enough to receive clear signals from the kinds of transmitters most amateurs presently use on microwave. The easiest check is to just try it.

Checkout

I have had an X-band beacon in continuous operation from a local mountaintop for some 10 years (see my article, "X-band Beacons," in the January 1987 issue of *Ham Radio*). Reception of a familiar, real-world, "known" signal from this beacon would prove the capability of the radar detector.

I rigged up a perfboard circuit with an LM317 variable voltage regulator and an audio amplifier (see Figure 5). This perfboard replaced the detector's controller circuit board. The LM317 circuit used a 10-turn pot for voltage adjustment. This circuit was designed to cover 3.64–5.9 volts, or 11.0 GHz–11.5 GHz, out of the VCO. The audio amplifier, an LM380, was connected to the audio output of the RF board's LM3089. Time for a DXpedition!

At a convenient location near my house, about 10 miles from the beacon, I can get a solid signal. I parked there and just pointed the modified detector through the car window and slowly turned the 10-turn pot—and there was the beacon's MCW ID signal! It wasn't strong, but it was surprisingly stable. And this is using only the radar detector's tiny horn for the antenna. I was sold on the fact that a modified police radar detector should make a great microwave bench-servicing tool and portable field-test receiver.

Further tests performed on the bench revealed that the modified radar detector produced usable audio when receiving signals from my M/A-Com Gunnplexer transceivers. It was also sensitive enough to pick up the 10 GHz calibration signal of a 1N23 diode driven by a 2 meter handheld (see "X-band Calibrator" in the April 1981 issue of *Ham Radio*).

The Final Design

The next step is to tidy up the circuitry, especially the added audio amplifier. Perfboard is not a good medium for high gain amplifiers of any frequency. A printed circuit board's solid groundplane helps keep unwanted oscillations and feedback under control (see Photo D and Figures 6 & 7). Two 10-turn pots with counting dials are very desirable for tuning the VCO. One, R2, serves as coarse tune. The other, R3, is fine tune. R4 and R5 set the range of voltage available. The values shown allow tuning through the entire amateur X-band (10.0 GHz–10.5 GHz).

These values may have to be adjusted to each particular Micro-Eye receiver. Be sure to test the final circuitry before plugging the new circuit board into the radar detector RF circuit board. Note that microphonics, or vibration-induced feedback, may be introduced if the speaker is mounted too close to the molded plastic shield. An S-meter, a zero-center tuning meter, and a frequency meter are optional add-on's.

The new circuit board can use the 6-pin connector that was removed from the unused controller circuit board. The optional zero-center tuning meter wires directly to pins 7 and 10 of the LM3089. The result is a circuit board that plugs into the Micro-Eye RF board, replacing the original controller board.

Packaging is up to you. I found that everything, including a NiCd battery, fit nicely in a 7" x 4" x 3" plastic box (see Photo E).

Parts List

Capacitors, all 16 WVDC or better.	
C1	25 µF electrolytic or tantalum
C2	0.1 µF
C3	100 µF electrolytic or tantalum
C4	4.7 µF electrolytic or tantalum
C5	0.1 µF
C6	1 µF electrolytic or tantalum
C7	1 µF electrolytic or tantalum
Resistors.	
R1	220 ohm ¼-watt fixed
R2	1k 10-turn pot (coarse tune)
R3	100 ohm 10-turn pot (fine tune)
R4	680 ohm ¼-watt fixed
R5	390 ohm ¼-watt fixed
R6	10k pot (volume)
R7	2.3 ohm ¼-watt fixed
Semiconductors.	
U1	LM317L variable voltage regulator
U2	LM380N audio amplifier
Miscellaneous.	
M1	S-meter, 100 µA movement
1	6-pin connector (remove from unused controller circuit board)
2	ten-turn counting dials
1	8 ohm speaker
1	PC board
Note: A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $6 + $1.50 shipping/handling.	
Optional, for center-tune meter.	
M2	100 µA zero-center meter
R8	4.7k ¼-watt fixed

Horn Antenna Extender

The Micro-Eye presents a bit of a problem if you want to change the antenna. Its antenna is rather closely integrated into the entire RF board design. You don't have a handy coax connector or waveguide flange to hook things to. Its horn does work quite nicely, and would probably make a satisfactory feed for a 1' to 3' dish.

As an experiment, I made an extension to the integral molded horn, fashioning it from double-sided copper-clad printed circuit board. The extension sleeves inside of the existing horn (see Photo F).

Remember: *You must be very careful not to touch the mixer diode located inside of the horn!*

This extension adds an estimated 8 dB of gain. Field tests verified a marked improvement in signal strength.

You could try modifications I didn't attempt, such as adding an AFC (Automatic Frequency Control), or replacing the horn antenna with an adaptor to a standard waveguide flange or coax connector. The latter modification would allow measurement of the noise figure of the receiver.

The BEL Micro-Eye police speed radar detector is easily modified for reception of the 10 GHz ham band. The cost is low and the performance is quite respectable. This device should serve as a useful accessory for the microwave amateur.

You may contact Steve J. Noll WA6EJO at 1288 Winford Avenue, Ventura CA 93004-2504.

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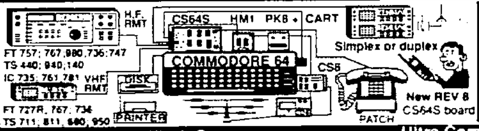

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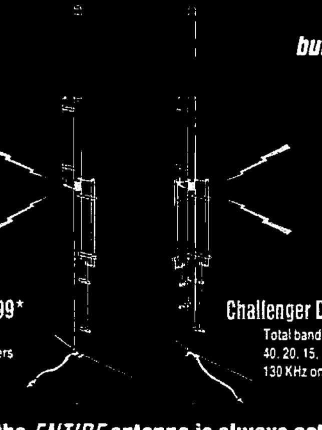

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UHF Source Dipper

The easy way to tune circuits from 400–500 MHz!

by Martin Beck WBØESV

Most amateurs who have used or tried to build a 432 MHz dip meter are familiar with the problem of the inductor being so small that it is useless for getting into UHF circuitry. All the so-called solutions I have seen are either clumsy ("I need three hands!") or mechanically unstable. The device described here solves all of these problems, as well as several others. It is small, inexpensive, unusually accurate, and a beginner can build it in four hours.

As the design emerged, I refused to budge from two requirements. The first was that the hairpin inductor be no shorter than 1¼". Second, I wanted a physical layout such that I could look at the tuning dial and, without moving my eyes, see the hairpin loop as it entered the circuitry being dipped. That meant having the loop on one end and the dial on the other. As you can see from Figure 3, this layout is particularly conducive to good UHF wiring techniques, resulting in a very handy little dipper that tunes from 400-500 MHz.

The three figures here show the construction process of the dipper. Note that the holes for the capacitor and extension shaft must line up for smooth tuning, and the brass mounting plate must fit the box you use.

In wiring this circuit, use very short, near zero lead length—this is crucial. (Figure 2 shows a blown-up version with too long lead lengths, simply for clarity.) Cut out and bend the brass plate to fit your box. Then use the actual components (capacitors, resistor, etc.) to aid you in punching the holes for everything. This is the best way to avoid excessive leads around the oscillator circuit.

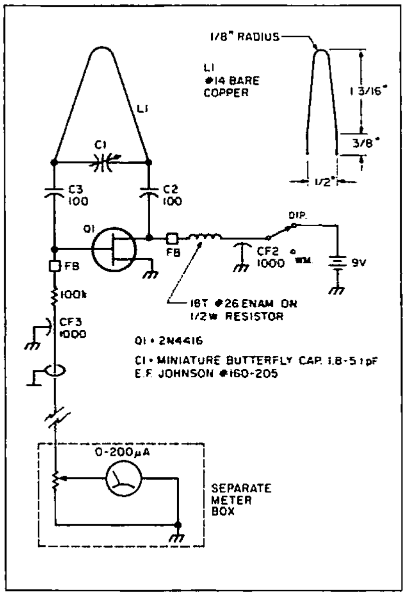

Figure 1. Schematic for the 400–500 MHz source dipper.

I was lucky enough to have an old National Co. ceramic FT-243 crystal socket. Teflon™, phenolic, etc. are OK. Unless you are an experienced VHFer, don't use a metal box. If you do, disaster awaits you! For convenience in replacing the battery, I bought a package of

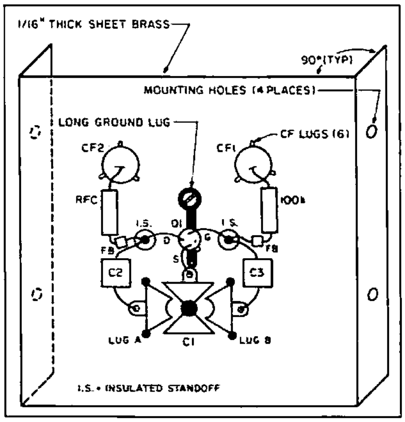

Figure 2. Details of the oscillator mounting plate (not to scale). Lead lengths are shown excessively long for clarity. Very short, near zero leads are mandatory. Note: The two pins on the crystal socket (hairpin coil socket) are soldered directly to lugs A and B. The long ground lug and Q1 source are soldered to the C1 grounding lug. Solder the feedthrough cap shields to the plate.

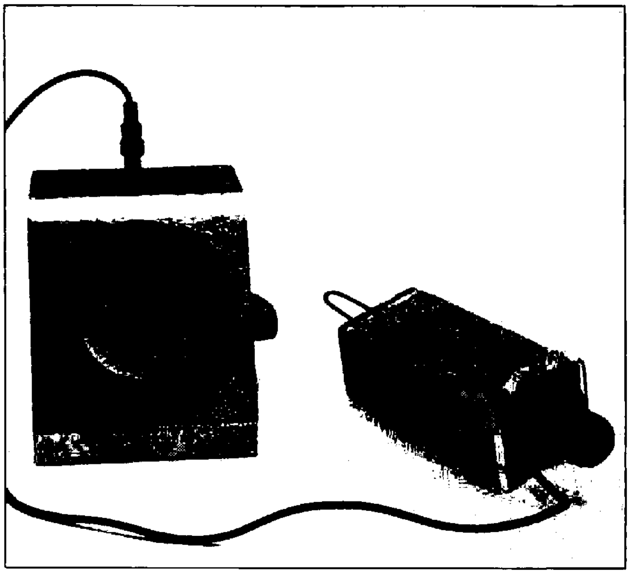

Photo A. The UHF source dipper with its remote meter.

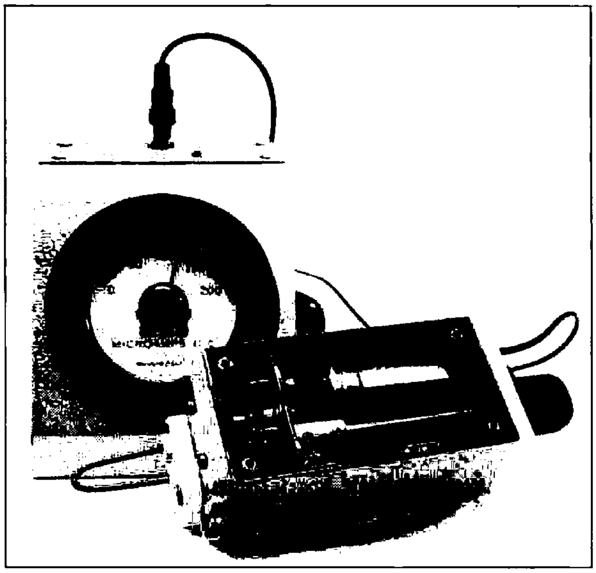

Photo B. Internal view of the dipper (note the coupler shaft placement).

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CIRCLE 31 ON READER SERVICE CARD

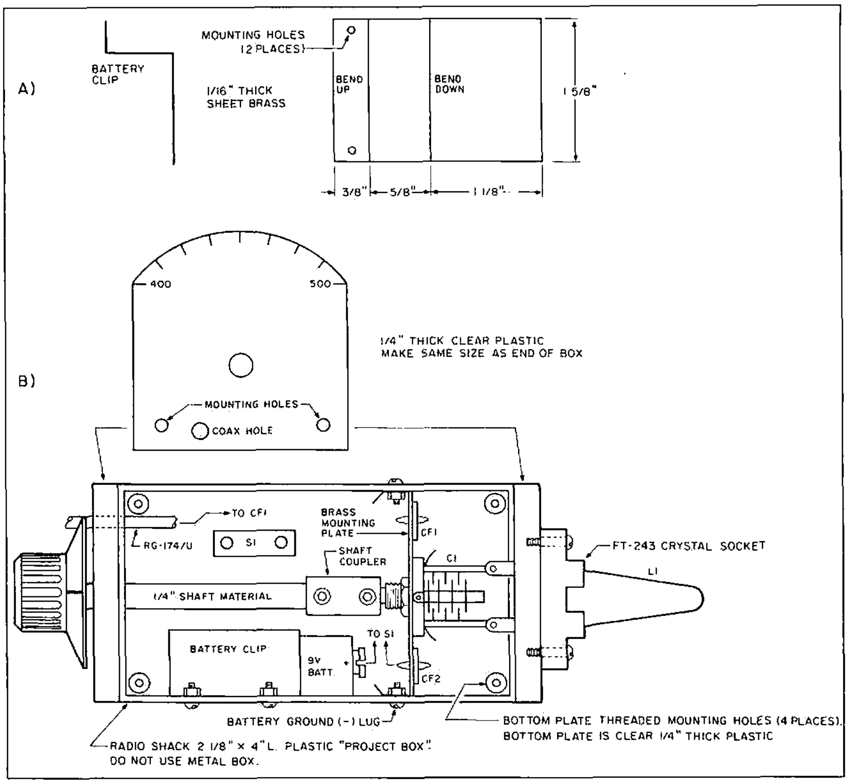


Figure 3. Battery clip (a) and bottom view showing parts placement (b).

Parts List

Q1	2N4416 transistor	
C1	1.8–5.1 pF miniature butterfly capacitor	(Cardwell #160-205)*
C2,C3	100 pF ceramic capacitor	
CF1,CF2	1000 pF feedthrough capacitor	
FB	Ferrite beads (2)	
M1	0–200 µA meter	
BT1	9 volt transistor battery	
SW1	SPDT switch	

Misc. components:
Length of RG-174/U mini-coax. Chassis for meter. 1/16" thick brass sheet.
Short length of #14 bare copper wire. FT-243 style XTAL socket.
*C1 available from Radiokit, P.O. Box 973, Pelham, NH 03076. Phone: (603) 635-2235.

snap-on 9 volt battery clips (with wires) from Radio Shack. Since most commercial or home-brew shaft couplers are ¼" in diameter, and C1 has a slightly smaller shaft, you can use a small piece of brass shim stock to mate the capacitor shaft to the ¼" coupler.

Below and left of the tuning knob is a small hole through which the coax is passed to the external meter. I used RG-174/U because it is limp and does not fight you as you move the dipper around.

Now, about calibration. You will be in the ballpark if you match my construction. However, it would only take a few minutes with a 500 MHz frequency counter. The dipper is totally portable so that you can take it to the counter. At any rate, it should be calibrated with reasonable accuracy initially. My unit holds its calibration exceedingly well. The range is shifted by lengthening or shortening L1. No other adjustment exists or is needed.

Since the wavemeter position is used in "hot" circuits, a piece of snug-fitting insulating tubing must be used over L1. I first used heat-shrink tubing, and then scrounged around for an appropriate size of Teflon tubing to go over it. It makes sense to use some other, safer device if you insist on measurements around high-voltage circuits!

Once you have this dipper built and calibrated, you will find it invaluable as a time-saver when making any sort of 400–500 MHz tank circuits. With no AC source required, it can be taken and used anywhere. Battery drain is only a few mils, so replacing the battery is a rare event.

This is the handiest, most accurate 432 dipper I have seen. Along with my UHF field strength meter (in this issue), it allows me to zip painlessly through my 432 projects. 73

Contact Martin Beck WB0ESV at 1637 Hood, Wichita KS 67203.

UHF Field Strength Meter

For 400 to 500 MHz.

by Martin Beck WB0ESV

This field strength meter will cover 400 to 500 MHz. I chose the tank components from several trial units, with the result that when tuning across an RF source within the design range, a very sharp upward kick of the meter occurs. Response is excellent at the design frequency, and extremely poor to nonexistent for nearby frequencies. If light coupling is used, the off frequency rejection is even better. The coupling is accomplished through a 1- to 2-foot length of RG-174/U mini coax, with a phono plug on one side and a small wire loop on the other.

Since we often deal with very weak 400-500 MHz energy, I have included a simple DC amplifier to drive the meter. The amplifier employs one transistor, with a potentiometer to vary its gain.

I calibrated my unit with my dip meter and a digital frequency counter of known accuracy. In a field strength meter (FSM) one should not expect frequency meter accuracy, but this one, with care in construction and calibration, can easily exceed what is generally necessary.

The schematic, drawings, and photos show all that is needed to build this device. Wiring associated directly with the tank circuit should emulate good VHF construction practices, use very short or near zero lead lengths.

Once your unit is completed and calibrated, you will find yourself being reassured that LO output really *is* on 404 MHz. For those who have no facilities for close calibration, the little 400-500 MHz dipper in this issue will do a good enough job for all but the most stringent situations. I "never really needed" a good 400-500 MHz FSM until I had one! I believe you will enjoy its help as much as I do. This FSM and its mate, the UHF source dipper (also in this issue) form a powerful pair that belongs on every VHF workbench. 73

Martin Beck WB0ESV, 1637 Hood, Wichita KS 67203.

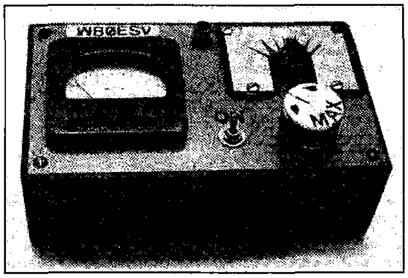


Photo A. The UHF field strength meter.

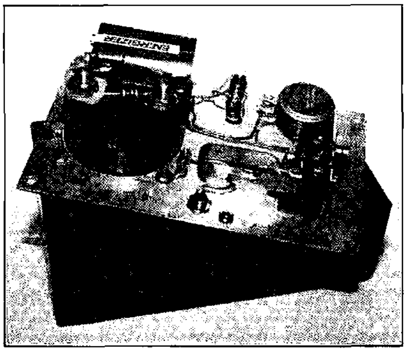


Photo B. Internal view of the meter.

Parts List

Q1	2N3906 or any small signal PNP transistor
D1	1N914 diode
C1	1.5–5.0 pF variable capacitor (Cardwell #160–102)*
C2	500 pF disc ceramic capacitor
C3,C4	680 pF disc ceramic capacitor
RFC1	7" #24 enameled wire 3.16" diameter close-wound with ⅛" leads.
L1	⅜" wide hobby brass strip 1/64" thick(see Figure 1)
L2	#14 bare copper wire (see Figure 1)
R1	10k potentiometer
R2	470 ohm resistor, ¼ watt
M1	0–200 µA (or 0–50 µA) meter
S1	SPST switch
BT1	9 volt battery

Misc. components: Project box (RS# 270-232), small brass sheet, two-terminal standoff.
*C1 available from Radiokit, P.O. Box 973, Pelham, NH 03076. Phone: (603) 635-2235.

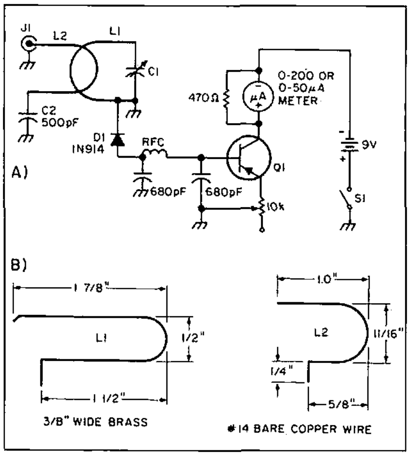


Figure 1. Field strength meter schematic.

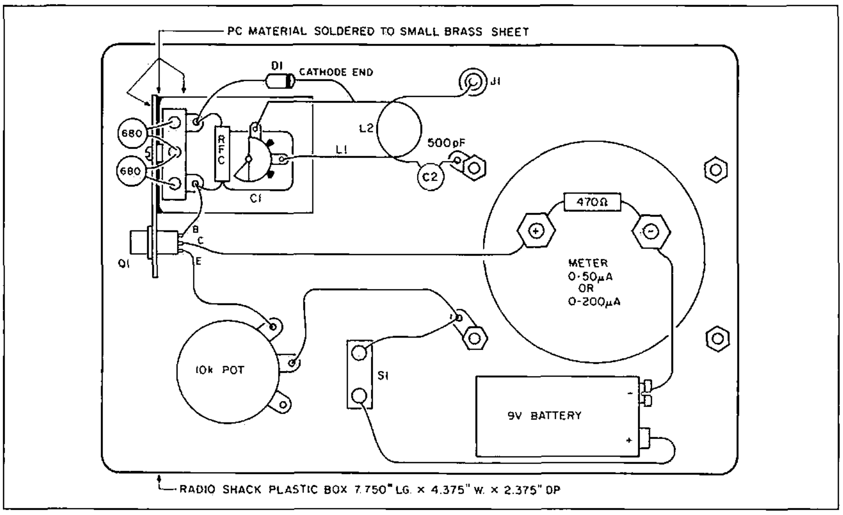


Figure 2. Parts layout for the field strength meter.

Great Ideas From Our Readers

Ending Transmit Chatter

Transmit "chatter" can be quite annoying on both repeaters and links. Most repeaters have a certain "hang time" where the transmitter stays keyed up after the input signal is lost. For home-brewed links and simpler repeaters that don't have these tail-timers, weak signals barely breaking a receiver's squelch can cause an annoying popping, as the link's (or repeater's) transmitter keeps toggling on and off. Here's a simple cure for that problem.

The 14538 monostable multivibrator (here wired in leading-edge trigger, retriggerable mode) gets triggered on the rising edge of the PTT's release. This generates a one-second pulse, during which time the signal will either return, or the circuit will drop out. Through the 4071, either a valid PTT signal or an output from the 14538 must be present to keep a transmitter toggled on. The duty cycle of the 14538 can be calculated by T = RC (T in seconds, R in ohms, C in farads). (See Figure 1a.) Remember to tie all unused inputs of a gate to the proper logic level. (See Figure 1b.)

When releasing the transmitter from transmit mode, the output of the 4071 is positive. Depending on the type of circuitry in your transmitter, this may be unacceptable, or you may wish to use a transistor buffer to protect your IC. If this is the case, I recommend substituting a 14001 for a 14071, as per Figure 1c. (The pinout of the 14001 is identical to the pinout of the 14071.)

Klaus Spies WB9YBM, Niles IL

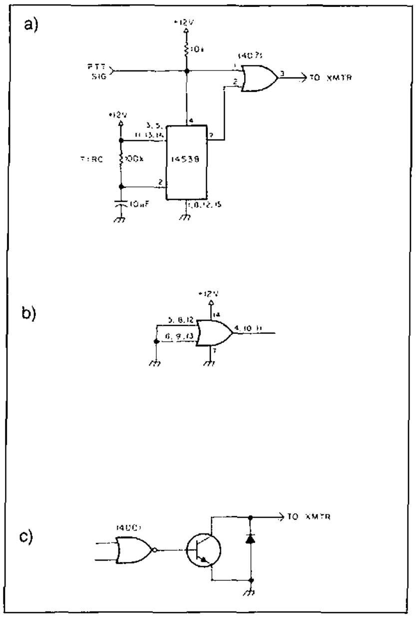


Figure 1.

Adding Digital Output to a Signal Generator

Many experimenters, being on a limited budget, often keep older equipment instead of buying newer equipment with more capability. Because of this, many of them are still using signal generators that do not have digital output capability. Modifying a sine-wave oscillator to give the digital output used in today's modern technology is much easier than most people may think.

Most modern waveform generators provide two digital signals, the second being basically the inverse of the first. The following circuit provides these two outputs, and has one major advantage. While most modern waveform generators provide only one output jack, this circuit, when properly enclosed in its own box, can have two output jacks, one for each signal polarity. The circuit is centered around the MC14093 (CD4093) integrated circuit. This IC is used primarily as a Schmitt trigger. (In this particular IC, the Schmitt trigger is in the form of a NAND gate.) Since the first Schmitt trigger inverts the incoming waveform as a by-product of its operation, another invert function must be provided to have the output signal (labeled "square-wave output") come out at the same phase as the input signal. There are four Schmitt trigger NAND gates available, so there is no problem using a spare gate as an inverter.

Schmitt triggers are used to "square up" noisy square-wave signals, and to take sine waves and convert them to square waves over their hysteresis curve. Note that the input (sine) wave must be symmetrical, and have no DC offset voltage, or the duty cycle of the output square wave will be affected. (This might be desirable in some experiments, but for basic circuits this should not be a major concern.) Reminder: It is always good engineering practice to tie the inputs of unused gates to an appropriate (high or low) logic level.

Let's consider IC output. For driving a typical circuit built by an experimenter, little else is required on the outputs of the 4093, except possibly a 100 ohm resistor between the output of the '93 and the "outside world." This will protect the IC from overcurrent should the output inadvertently be connected to a high voltage, or be shorted to ground. If you expect that the '93 will have to drive several ICs at one time, or if for some other reason you expect a higher load, I strongly recommend that you use a 2N2222A transistor as a buffer/driver.

Another consideration is a housing for the IC. While a single IC can be mounted on almost anything (no critical or special circuit board is required), remember that all power leads should be suitably filtered to ensure pure DC. They should also be bypassed to get rid of any high-frequency noise caused by such things as a high generator frequency, and (for all of those doing work with radios) to bypass any RF from getting into the circuitry. This shielding includes putting the IC into a metal box, and **GROUNDING THE BOX TO THE POWER SUPPLY GROUND**—don't leave it floating!

The 14093, being a CMOS IC, can accept up to 18 volts for supply, with the input signals not to exceed the supply voltage (regardless of which supply voltage you decide to use). This capability can provide another feature for our circuit. A simple switch can toggle in a 5 volt supply to the IC when a 5 volt maximum output is required while experimenting with TTL components. Or, a switch can be toggled to provide 12 volt levels when working on CMOS ICs or other 12 volt circuits (like those found in many mobile radios).

With this circuit, we have now not only brought old (nondigital) signal generators up to modern capability levels, we have also surpassed the capabilities of some of the lower-priced modern generators.

Klaus Spies WB9YBM, Niles IL

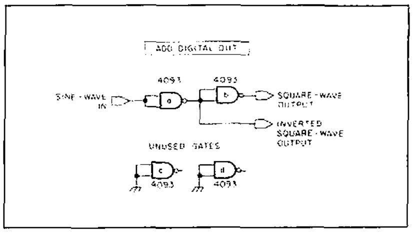
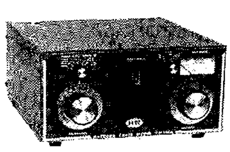


Figure 2.

ANTENNA TUNERS

1500W.



MODEL VS1500A ANTENNA COUPLER

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FEATURES INCLUDE:
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  VERTICAL — MOBILE WHIP
- ACCEPTS COAX BALANCED LINE OR SINGLE WIRE FEEDLINE
- BUILT-IN ANTENNA SWITCH
- BUILT-IN WATTMETER WITH FORWARD AND REFLECTED POWER FOR SWR MEASUREMENTS
- WATTMETER ACTIVE EVEN WITH TUNER IN BYPASS POSITION
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- RUGGED 4:1 BALUN FOR BALANCED FEEDLINE

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CIRCLE 53 ON READER SERVICE CARD

73 Review

by David Cassidy N1GPH

The Kenwood TH-27A

A mini HT with maxi features.

Kenwood U.S.A. Corporation
P.O. Box 22745
2201 E. Dominguez St.
Long Beach CA 90801-5745
Tel. (213) 639-4200.
Price Class: $420.

I got my first glimpse of Kenwood's latest entry into the micro-HT arena last September at the Southwest Convention in San Diego. Still awaiting FCC type acceptance, the rig was loaded with a dead battery by the careful Kenwood reps. We couldn't even play with it! Needless to say, this was a tantalizing first look at what has finally come to market as the Kenwood TH-27A.

First Impressions

The first thing you ask yourself upon seeing this little rig is, "Where's the battery?" Unlike most HTs, the battery pack does not hang off the bottom of the unit. Nor is it inside, like the internal battery in ICOM's mini IC-2SAT. The battery pack slides neatly and solidly *into* the bottom of the unit's case, where it disappears from view. The battery, a standard 7.2 volt 700 mAh type, provides about two hours of life at high power (1 minute xmit/3 minute receive ratio). If you leave the power set on low, you should see nearly four hours of operation.

Speaking of power, instead of the usual "High/Low" power choice, the TH-27A offers four choices: HIGH, MEDIUM, LOW, and ECONOMIC LOW. The HIGH setting will give you 5 watts with a 12-volt source and 2.5 watts with the 7.2-volt battery. MEDIUM power provides 2 watts, LOW power provides ½ watt, and ECONOMIC LOW gives 20 mW. The manual states that you'll get about 15 hours of battery life if you leave the power on ECONOMIC LOW. I suppose that would be enough juice to get around a fairground or short parade route.

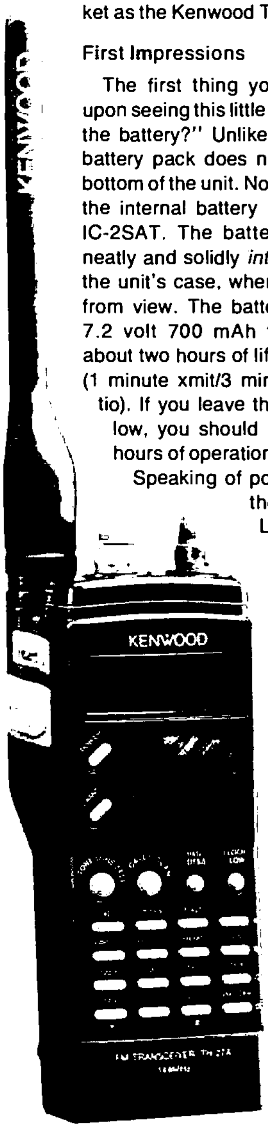


Photo. The Kenwood TH-27A—all curves and full features.

For the past several years HTs have been getting more and more complicated, with more and more features. With the TH-27A, I think we have finally reached the saturation point. This is the first HT that I actually had to read the instruction manual for before operating it. Once you understand the procedures, they're no more difficult than any other modern HT, but the sequences are not readily apparent. Alas, I fear that this will become the norm, as every manufacturer will now want to include all the available features in their products.

The unit is turned on by a front panel button, as opposed to the standard volume control knob. The power button must be depressed for 0.3 seconds for the unit to be activated. I have to say, this seems like something that was designed into the unit for the sake of being different. I can't think of any reason why the standard volume control switch wouldn't be preferable. In fact, although the button is recessed somewhat from the rest of the case, it wouldn't take much for the radio to be turned on by accident. This happened to me when I packed the TH-27A in my suitcase the night before a trip. The only thing that saved me from finding a dead battery was the automatic power-off feature, which turns the radio off after one hour of inactivity.

This little radio feels very solid in your hand. It is obvious that Kenwood has put a lot of thought and design time into the ergonomics of this rig. Every corner and angle is rounded, with no sharp edges. The entire radio is shaped in a very slight "V" angle which fits the curve of your palm and makes the PTT switch fall right under your finger, whether you're a lefty or a righty. The thin and flexible rubber ducky antenna has a covering that comes over the BNC connector and sits flush with the radio housing. This adds much to the sleek appearance of the unit, but it means that there is a definite front and back to the antenna. You can attach it any way you choose, but it is obvious that the antenna and radio were designed to look good a certain way.

The top of the radio holds the volume, squelch and tuning knobs, as well as the speaker, microphone, and DC jacks. All other functions, including the LCD display, are on the front of the rig. This means that there is nothing on the back except the belt clip. This is a trend that I hope continues in HT design. I have always found it downright aggravating to have to hunt for switches or buttons on the back of an HT, especially if you're like me and always keep your HT in a protective case. In addition to the standard 16-button keypad, there are four round buttons which control various functions, as well as the power and lamp buttons. All buttons (except power and lamp) control multiple functions. You won't damage anything by simply experimenting with the different buttons, but this is one radio that forces you to refer to the manual.

The LCD display shows a complete picture of your operating parameters. . .and, I do mean complete! There are 26 separate symbols that inform you of every possible setting. As in most HTs, the display must be read from below or straight on, but even then I found the display a bit on the dark side. The plastic window lies flush with the radio housing. In fact, it is slightly convex. This adds to the physical beauty of the radio but does nothing to protect the window from scratches. Two green LEDs provide illumination. A push of the button will light the display, which will stay lit for five seconds after the last key operation. You can have constant illumination by first pressing the function key.

The speaker audio is surprisingly good for a radio of this size, and the transmit audio is what we've come to expect from Kenwood. Some people prefer transmit audio that boosts the high end, feeling that it increases the communications quality, but I find it tiresome to listen to for any length of time. After all, this is FM. There's no QRM to cut through, and if you're in a noisy environment you're going to have to use an earphone (or hold the radio to your ear) anyway. Kenwood's audio is more evenly balanced and I've always found it easier to listen to.

Frequency Management

Most HTs are placed into either VFO or MEMORY mode by the push of a button. The TH-27A is unique in that MEMORY mode is always available at the push of a single button. It took some time to get used to, but once I became comfortable with the system I found it very convenient.

To access the VFO, you press the ENTER key. This blanks the frequency display and allows you to directly enter a frequency with the numeric keypad. You may now tune the VFO with the tuning knob, or repeat the proce-

dure (first hitting the ENTER key) to directly enter another frequency. Hitting a numeric key without first hitting ENTER will immediately choose the memory channel of that number. Once you are in memory, the tuning control will change the memory channels, or you can simply hit another numeric key to access a different memory channel.

This procedure confused me at first, mostly because I was trying to stick to my "never read a manual first" philosophy. A quick read of the appropriate page in the manual made everything clear. For the next few days I would still try to enter a frequency without first hitting that ENTER key, immediately accessing the appropriate memory channel, but in time I became comfortable with the procedure.

You may also return to the VFO from memory by simply hitting the numeric key for the memory channel you are currently in. For example, if you are currently in memory channel 5, touching the 5 key will immediately transfer you back to the VFO. This feature would be very handy for public service or emergency operation, where net control was on a local repeater but on-sight and other communications were on another repeater or simplex frequency. No need to remember what memory channel holds the secondary frequency. Simply put it into the VFO and you can switch instantly between the two.

Thanks for the Memories

There are 40 memory channels and three ways to access them—single number, two number, or tuning knob. With single number entry, you can immediately access memory channels 1–9 by touching the appropriate number key. Channels 11–40 can then be accessed by turning the tuning knob. In two-number entry, all memory channels may be accessed by the number keys, but a 0 must be entered before channels 1–9. Since I travel around the country quite a bit, I found this way of managing memories very convenient. I simply leave the local repeaters in memory channels 1–9 and set the access to single number. When traveling, I enter the new frequencies into the higher memory channels and switch to two-number control. Upon returning home, it's back to one-number access until the next trip.

Memory channel 1 also serves as the priority channel. With the priority alert function on, the radio will sound a tone to let you know when there is activity on that frequency. If you choose, you can set the priority function to immediately switch to the priority frequency, but I think most would opt for the alert tone only.

There is also an independent call channel memory, accessible by a touch of the CALL button. Many hams like to keep their home repeater or local simplex calling frequency in this position. The immediate entry also lends itself to public service work, as mentioned earlier.

Scanning Around

The TH-27A has seven scanning options and three scanning modes. The scanning options are:

Band Scan—which scans over the entire band.

Programmable (PROG-1, PROG-2) Band Scan, 1 and 2—two user-programmable scanning ranges.

MHz Scan—scans over a 1 MHz range.

Memory Scan—scans through all memory channels that have data stored in them and that have not been locked out.

VFO/Memory Scan—alternate scanning of the VFO and the last used memory channel.

Call/VFO Scan—alternate scanning of the VFO and the CALL channel.

Call/Memory Scan—alternate scanning of the CALL channel and the last used memory channel.

In addition to all this, there are three scanning modes. SEEK scan will stop on a busy channel. CARRIER scan will stop on a busy channel, but resume scanning two seconds after the carrier drops. TIME scan stops on a busy channel for five seconds, then resumes scanning even if a signal is still present.

Features, Features and More Features

The TH-27A has the full boat of features we've come to expect in our HTs. Although there is not enough room in a short review to discuss them all (the manual is a full 51 pages), a few of the highlights include:

Tone Squelch/CTCSS. Subaudible tones are programmable and may be used in transmit (to access repeaters) and/or in receive. When used as a tone squelch, your HT remains silent unless the correct tone is present. This is very convenient for monitoring a busy repeater or a simplex frequency at a hamfest. You and your friends decide on a tone to use and you won't have to listen to everyone else's communications. The tone encoder is standard equipment on all TH-27A's sold in the U.S. and Canada. I hope the days of paying extra for this feature are over.

DTMF Memory. Up to 10 telephone numbers of up to 15 digits each may be stored in memory. Call up your repeater's phone patch, push a button, and you're all set. The tones are played through the HT's speaker while being broadcast. It may be totally psychological, but I like to hear the tones (my old Kenwood TH-25 doesn't do this, and it has always bugged me).

Dual Tone Squelch System. This feature keeps your squelch on until the proper three-digit code is heard. This is similar to the tone squelch, except that it's activated by regular tones instead of subaudible tones. This would be handy if any of your friends don't have subaudible tones.

Paging. There is a "Dual Tone Multi Frequency" paging system, the explanation of which takes up six pages in the manual! Basically, it allows you to store your own paging code, and those of other individuals or groups, into memory. This allows you to silently monitor a frequency, until one of the group pages you. The manual doesn't do a very good job at explaining this rather complicated system.

Clock. The TH-27A may be set to display a 24 hour clock.

Timer. In addition to the regular "power off" feature (the transceiver shuts down after 59 minutes of inactivity), you may set a "power on" and "power off" time in conjunction with the 24-hour clock. Just set the time of your local VHF net, and your TH-27A will turn itself on at that time. You can also set it to shut itself off.

Pros

This little rig has a lot going for it. Some of the things I really like are:

Overall design. The TH-27A is a beautiful radio. Kenwood ought to submit it to the Metropolitan Museum.

Overall quality. This is as solid a radio as you're going to find. A lot of the solid feel has to do with the unique battery arrangement. The battery slips up into the transceiver with a nice solid "click." The rubberized knobs and buttons feel very secure.

PTT switch. You may think this is really picking nits, but many of Kenwood's previous HTs had PTT switches that were hard to push. Try spending a day wrestling with the PTT switch on the TH-25, and you'll start to appreciate a smooth and light PTT switch. The PTT switch on the TH-27A is easy to operate, even after several hours.

Included features. The TH-27A has a plug for direct 12-volt input. The subaudible tone encoder is also standard. It's about time these two features became standard on all HTs.

Power settings. The choice of four power settings allows for maximum battery life.

Cons

Nothing in this world is perfect. Some of the things that bugged me about this radio are:

Power switch—it's too easy to turn the radio on or off by accident. The standard volume control switch would have eliminated this problem.

Non-recessed LCD display. It looks great, but I bet every TH-27A we ever see will have scratches across the display window.

One-way antenna. Again, it looks great, but couldn't it have been designed without the front and back sides different?

Manual. The manual for the TH-27A is full of those grammatical errors that at best make for comical reading, and at worst make for confusion and frustration. Kenwood's manuals are generally pretty good, so I don't know what happened with this one. I hope they'll consider rewriting it.

Final Comments

I really think Kenwood has a winner in the TH-27A. The high quality is evident as soon as you hold it in your hand, and the 7.2 volt 700 mAh standard battery is nice to have in such a small HT. The small size makes it easy to pack away for trips, or carry on your belt all day. There's also a 440 MHz version (the TH-47A) for those who need it.

If you're currently shopping for a new HT, I would strongly suggest taking this mini for a test drive. 73

David Cassidy N1GPH is the Associate Publisher of 73 Amateur Radio Today. *You may write to him % 73.*

Future Modulation Amateur Television

Sometimes called frequency modulation.

by Don C. Miller W9NTP

How would you like to forget problems of sync clipping and nonlinear power-limited amplifiers? Amateur television enthusiasts today have the opportunity to free themselves from many of the problems that have plagued them for the last thirty years. Gone is the need for line samplers used to adjust sync, white and blanking levels after the signal has passed through the stages of amplification. The video signal may be improved by 20 to 30 dB over the conventionally transmitted AM television signal. Amateurs reading this article may wonder how they could have missed these great improvements in ATV transmission.

The truth is that amateurs in general did not miss the advantages of frequency modulation (FM) ATV. Only the American hams have missed it. By traveling around the world visiting ATV hams, I have found that FM ATV is used exclusively by European and other foreign ATV enthusiasts. Hams recognized the advantages early on but, since spectrum space was not available on the 70cm band, it wasn't until activity on the 1200 MHz band became popular that it really started to grow in Europe. The lack of available equipment became a problem. If amplitude modulation had been considered, the problems would have been even worse. Semiconductors are notorious for their nonlinearity so the possibility of operating them in Class C mode became the first real advantage of FM ATV in getting some power on the air. In case the reader does not understand the difference between linear amplifiers running at near half power and class C amplifiers running at full power, consider the following.

In amplitude modulation, the modulating waveform is asymmetrical. The video signal is a wide bandwidth signal which is combined with a vertical and horizontal sync signal. The waveform becomes asymmetrical with the sync signal in one direction (maximum power) and the video signal in the opposite direction. The peak power always refers to the power of the sync. In an amplitude system, when nonlinear amplifiers are used the sync signals may be compressed by operating the amplifiers with too much average power output. The Bird wattmeter may read higher when overdriving the amplifier, but a line sampler in the antenna lead will show that the sync pulse has been greatly reduced in height.

With FM ATV, since the sync pulse is modulated in an FM mode, the amplitude of the transmitted signal is constant. The amplifier can be operated at maximum power for as long as the transistors can survive. This is a distinct advantage at UHF, where it is so hard to maintain high power and still have a good waveform. This is the reason that the FM repeaters on two meters and other VHF/UHF bands use voice FM. Single sideband would be more efficient if it were not required to have linear amplifiers, like amplitude modulated television.

Some examples of the use of FM TV are found in commercial and military fields. Today we see satellite dishes in backyards. These antennas are directed toward satellites that broadcast high quality commercial TV. They all use FM for their video transmission. When you see a local TV broadcast station do a remote from a site where action is taking place, they use FM TV. The military use FM TV on all of their television guided missiles. This leads one to believe that there must be something superior for the FM mode over the AM mode.

I feel that amateur radio has existed over the last fifty years only because of its technical contributions. Amateurs experiment and develop new modes and equipment that later show up in commercial use. They also give Third World countries an opportunity to have a free source of electronic and communication technicians that these countries would not be able to afford otherwise. FM ATV affords an opportunity to experiment and build equipment to test out new bands for propagation and other unknown results.

I have always been critical of ATV in America because hams chose to use techniques and circuits that were designed in 1940. Costs were a factor, and equipment discards from commercial usage made it possible to have a lot of fun, but it does not advance the state of the art. A glaring example is the continuous use of the NTSC method of sending color on ATV. If you examine modern methods of sending color you will find that almost any other method is better. When high definition television (HDTV) becomes a reality you will find that a system called Multiple Analog Components (MAC) may be used. This is a system where a single line of TV is divided into two or three parts. Part of the line is the color signal and the other part is luminance, or black and white signal. Slow scanners have been using this method of sending color for 10 years. Why not try it on ATV?

How do you get started in FM ATV? First, you should read the literature. The British

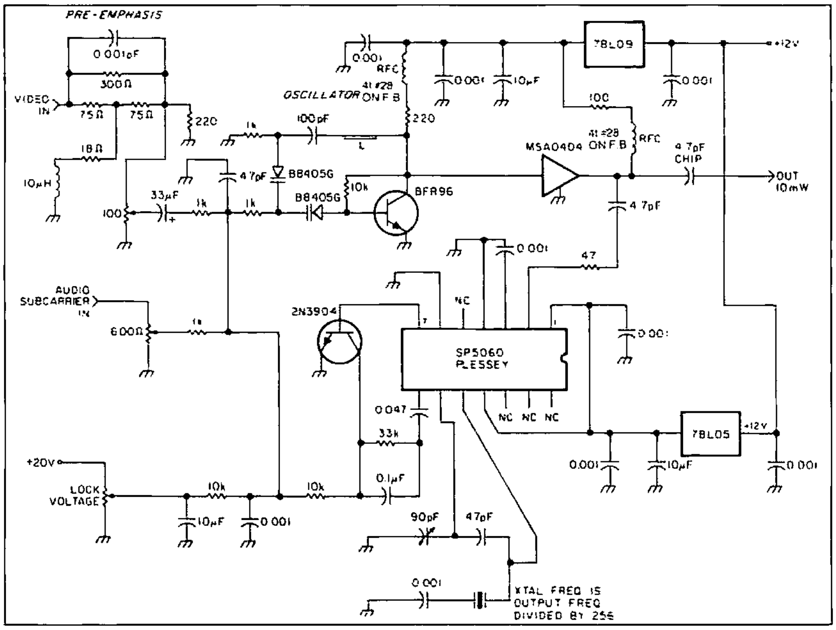
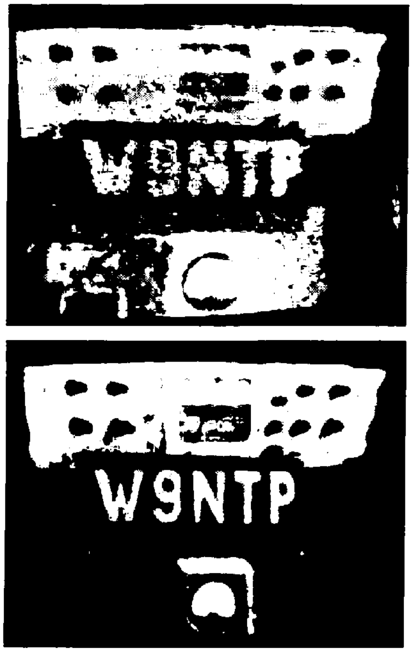


Figure 1. Basic circuit used to produce FM-ATV on 23cm. (Modified from a circuit from the January 89 issue of VHF Communications, p.25).



Photos A & B. Comparison of AM & FM ATV. Top photo is that of a 1 watt 1255 MHz AM ATV transmission over a lossy path. The bottom photo shows the result of using FM modulation over the same path. Note the increased picture quality.

Amateur Television Club magazine is a wealth of information both for circuits and equipment kits. A second magazine called *VHF Communications* from Germany, printed in English, publishes circuits and sells kits for building your own system (kits are available for all circuits). If you are interested in a very good theoretical article on the comparison between AM and FM ATV, I refer you to *VHF Communications*, March, 1986. If you are unable to find this issue, send me a green stamp for a copy.

Since good circuitry for FM ATV is hard to obtain at low cost, many of the first circuits were free-running oscillators that were varied in frequency by a varactor diode modulator. The most popular one that has been produced hundreds of times around the world is called the "Solent." The Worthington group of the BATC still sells this kit. Recently it has been updated by locking it to a crystal oscillator.

Some of the highest quality FM ATV units built today come from a British company called Wood Douglas. Their modules are very well made and are crystal-locked so that you don't have to chase the signal around the band. With FM ATV, signal drift is not serious because of the nature of detection and bandwidth. Wood Douglas makes transmitter modules (10 milliwatts output) and 1200 MHz downconverters which convert to their IF FM ATV board, giving output video and audio. The amateur only needs to connect the output to a computer monitor and he is ready to receive video and audio.

With the British pound increasing even more and the desire of Wood Douglas to discontinue their amateur radio line, Wyman Research developed a new unit which has proven to be superior in design to the original Wood Douglas exciter, and at a much lower price.

A British company called Plessey has developed a chip that is unique to the semiconductor world. This chip is phase-locked-looped and has a divider chain that inputs a 1200 MHz signal at a rather low level, divides it by 256 and locks it to a crystal in the 4 MHz range. The loop is adjusted by varying the voltage on a varactor diode to bring the free-running oscillator into range. Once the loop is locked to the crystal, video and audio subcarriers can be added to the loop control voltage to vary the frequency to produce FM ATV which is locked to the carrier frequency. The circuit is extremely easy to get going and is the basis of most of the FM ATV systems around the world. Included in the circuitry is a preemphasis circuit, standard to all FM ATV, which increases the deviation at high video frequencies. This is later compensated for by using deemphasis at the receiver to restore the proper levels (see Figure 1). *[Ed. Note: A PC board or kit is available for this transmitter. See address at end of the article.]*

A word about FM ATV receivers: Those of you who are flea market buyers may want to try discarded satellite receivers. Caution is in order. Satellite receivers are designed for larger bandwidths and deviation than is used on amateur FM ATV. The result is that there is increased noise in the received signal because of the added noise in the unused passband, and the level of the video is much less than normal because of the lack of full discriminator detection. A real experimenter should be able to decrease the bandwidth and add a stage of video gain to make them usable. Don't judge the results of FM ATV by using a satellite receiver. A receiver designed specifically for FM ATV will do remarkably better.

Note that I've said nothing about using a TV set in an FM ATV system. After all, we have been talking about Future Modulation (FM) not Ancient Modulation (AM). If you insist, however, an ordinary TV set can detect an FM ATV signal poorly by using the principle of slope detection.

Those of you who have trouble building AM video transmitters should have no trouble building FM video transmitters. After all, most of the complicated circuitry has been eliminated.

I would enjoy receiving comments in regard to FM ATV. The cost per watt for FM ATV is now lower than AM ATV. Considering the fact that no expensive test equipment is required to build the gear or align it makes it a very good mode from an economic viewpoint. 73

Subscriptions to the BATC as well as a line of FM ATV equipment are available from Don C. Miller W9NTP at Wyman Research, Box 95 RR 1, Waldron IN 46182. Phone: (317) 525-6452.

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Take A West Indies DXpedition?

"No Problem, Mon!"

by "Dee" Logan VP2E/W1HEO

Can three Ohio couples combine a vacation and DXpedition to the West Indies, rack up 4,273 QSOs in five days, plus avoid serious sunburns? As they say on Anguilla, "No problem, mon!"

The idea for our DXpedition to Anguilla originated with several members of the Lake County (Ohio) Amateur Radio Association. All shared the fantasy of someday finding themselves in a rare DX location, being pursued by the multitudes and working the pileups. As exciting as that idea was, we broadened its appeal by combining it with a family vacation.

Our casual talk turned serious when several club members and their spouses began meeting over potluck dinners to plan the real thing. First, what was our criteria? We decided on a somewhat rare DX country that had reciprocal licensing with the United States, was in a warm vacation spot served by commercial airlines, and had affordable lodging that allowed ham radio operations.

Selecting the Location

Each of us agreed to research one or two possible spots. For several weeks we collected information, with the Caribbean a favorite area. Our short list included Montserrat, the Bahamas, Virgin Islands, Anguilla, and the Turks and Caicos.

After completing our individual research, we reassembled to make our selection. There were several attractive possibilities. Some hams rent Caribbean vacation retreats that are completely equipped with ham radio stations. However, we felt that since these were widely advertised, they would tend to be well-occupied and thus less rare.

Anguilla was especially interesting to me. If you want good information on a DX country, ask someone who lives there. I ran across VP2EHF on 20 meters one day and quickly plunged into a detailed discussion with Dave about Anguilla. He said that there really weren't many hams on his island—perhaps six. This was good news. It sounded to me like a somewhat under-represented country on the air and thus a good candidate.

Anguilla, I learned, is the northernmost of the British Leeward Islands. It lies some 150 miles east of Puerto Rico, just seven miles from St. Martin. A small island, it's only 16 miles long and three miles wide. Its long, serpentine shape was noted by Columbus, who sailed by in 1493 and dubbed it Anguilla, the Italian word for eel.

Unlike some Caribbean islands that offer exotic scenery such as mountains or rain forests, Anguilla is rather plain. The 35-square-mile country is flat, rising only 213 feet above sea level. It's also dry. There are no streams, rivers or waterfalls, and most of

Photo A. The VP2EOH DXpedition's main operating location—a seaside villa on Anguilla. Note the 15-foot tower and tribander on the roof. The flat roof made antenna installation easy.

Photo B. The tower for VP2EOH was borrowed from an Anguilla ham, and the tribander was donated to the island's Boy Scouts afterwards.

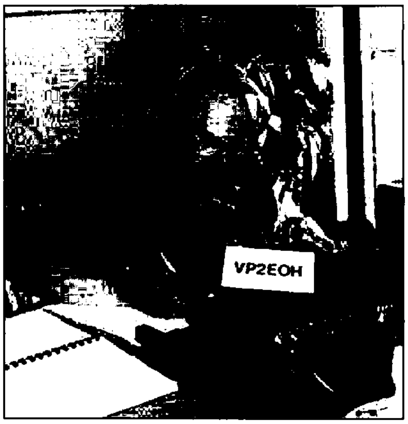


Photo C. VP2EOH, operated by Dee, W1HEO, on Anguilla during April 1990.

Photo D. On a beach on Sea Feathers Bay, across from the operating site, VP2EOH expresses satisfaction with the DXpedition results.

the vegetation is low-lying grasses and cactus.

For seekers of glitter and nightlife, Anguilla is definitely not Las Vegas. It is quiet, calm, and has no cities at all. While there are a few exotic, pricey resorts on the island, for the most part Anguilla is residential, with a few shops and markets scattered here and there.

So why visit the place? The answer is found on its sparkling white beaches. There are 30 of them, along with colorful coral stretches offering some of the world's best scuba diving and snorkeling.

For a ham, the island is ideal. No mountains block your signal. Easy licensing: Show your U.S. ticket and pay a $38 U.S. fee. Electrical supply is 115 volts, 60 Hz alternating current. Nights are quiet, with little manmade interference.

Additional details on VP2E came in a comprehensive DXer's guide published by the Anguilla Amateur Radio Association. (Available from P.O. Box DX, The Valley, Anguilla B.W.I.) Anyone planning a DXpedition there should write for this handy reference.

We selected Anguilla on its many merits. Certainly one of them was that it was an undeveloped island that wasn't overrun with either tourists or hams.

Getting Ready

A remaining task was finding a place to stay. Our prime requirement was a hotel or villa that welcomed hams. Several candidates were identified by Scott KO8O. The off-season rates began in mid-April, and we found some neat villas available then on the south side of the island at Sea Feathers Bay. And they welcomed hams!

Now for the deposits and reservations. Which of the group would go? Three couples decided to make the trip: Bob K8BL and his XYL Marcia; Scott KO8O and wife Jo; and myself, "Dee" W1HEO, and spouse Liz. We all dug deeply into our credit cards and took the plunge.

In the months leading up to our trip we pulled together the radio gear. We all agreed that to assure a good signal we'd run a yagi. Fortunately, we found a small triband beam at a sale price. It was assembled, checked out for low SWR, and then shipped to Anguilla well ahead of our departure date. (We donated the beam to the Anguilla Boy Scouts after our DXpedition.) We also carried along a 40-meter inverted vee, but opted not to operate on 75 meters, figuring there would be enough activity on 10-40 meters. We were right! We took an ICOM 735 transceiver and borrowed a power supply from a VP2E ham. We decided against bringing an amplifier. It would be too heavy, and we doubted that we'd need it. Right again!

On a cold, snowy morning on April 18, 1990, we began our trip. A great day to fly south to the sun! Our flight took us to San Juan, Puerto Rico, with several hours between planes for sightseeing. We headed for old San Juan, with one of our main stops the El Morro Castle, a large fortress rising 140 feet above the sea. After some shopping and a bite, we left on the last leg of our flight, arriving in Anguilla after dark. It had been a long day.

We awakened to our first day on Anguilla with a glowing sun and sparkling cobalt waters of the Caribbean outside our villas. That's what we came for. Another was the ham license. We headed for the offices of Radio Anguilla and presented ourselves to the official in charge, Nat Hodge. He wrote our simple, one-page licenses, collected $38 U.S., and also issued us a special callsign, VP2EOH. Since we qualified by operating in a contest—the North American QSO Party—we picked EOH for Eastern Ohio Hams.

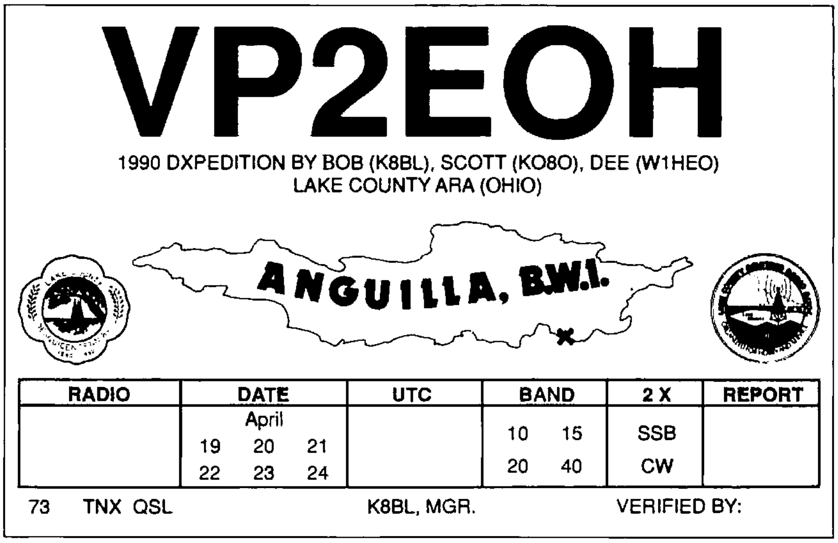
Setting Up and Getting On

Getting the station together was next. We had borrowed a 15-foot aluminum tower to support our tribander, but discovered to our surprise that it was still in the box! So, around 1:00 p.m. we began the complex assembly job. We worked in what little shade we could find, since the sun was high and so was the humidity. Even natives complained about the heat. The tower was a problem. It didn't go together right. We tore it apart. We rebuilt it. Three times! Finally, we settled for a reasonable approximation of its intended design, ignoring the parts left over.

Since the villas we rented had flat roofs, it was easy to erect the tower and beam and hang the inverted vee from the top, dropping the ends off each side of the villa. Then came a problem. As we checked out the rotor and plugged in the transceiver, the rig died! While it worked in the FM mode, it was going nowhere on SSB. Bob K8BL tore the unit apart, searching for a clue. Murphy had struck again!

After puzzling over the rig for some time, Bob grabbed his voltmeter and checked some things. Bingo! The coax feedline to the antenna showed 70 volts AC. No wonder the rig was tripping out. We unplugged the rotor control and the stray voltage disappeared. While we had no idea why the problem existed, we decided to simply leave the rotor unplugged and apply power only with the rig off the air. At last we were ready to send our brand new VP2EOH call letters to waiting DXers!

We began by checking 10 meters. We were in luck! The band was hopping, with signals pouring in from stateside. Our first call



VP2EOH

1990 DXPEDITION BY BOB (K8BL), SCOTT (KO8O), DEE (W1HEO)
LAKE COUNTY ARA (OHIO)

ANGUILLA, B.W.I.

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brought an instant response from one of our fellow radio club members, Mark KB8FKM, who had obviously been camped out on frequency waiting for us to show up. Signal reports were good, so obviously we were doing well with our 100 watts. The salt water assist was dramatically evident.

And the pile-ups! While we realized that VP2E was somewhat in demand, we didn't realize what the sound of that demand would be at our end. It sounded like buzzing bees, with no calls heard. We quickly decided that if we were to achieve an efficient rate of contacts, we would have to maintain discipline on frequency and use a system to pick out the calls.

Our system was to go by call areas whenever the pile-ups got bad and, when necessary, to make up short lists based upon the last two letters of a call. We tried to give our QSL route, location, name and other info about every five minutes or so. We also thanked people for being patient while we worked as fast as we could. In fact, most operators—especially the stateside DXers—are to be congratulated for their on-the-air discipline.

For five days we kept VP2EOH on the air about 18 hours daily. We alternated operating, eventually settling on a two-hours-on, four-hours-off cycle. Two hours of intense operating in the tropical heat was about the right span. After that, it was time to hit the beach or go sightseeing.

While checking out the island in our rental car, we drove carefully on the left side of the road, stopping at shops, restaurants, craft galleries and various beaches. Snorkeling and scuba diving were excellent. Our villas provided us with a great view of St. Martin nearby, so we naturally took the 20-minute ferry ride over for a look. French restaurants abound, so we sampled some of the cuisine at lunch. It was outstanding! Later, we discovered the 2 meter repeater on the island and used it to contact locals VP2EOH and VP2EE.

Our experience with big pile-ups showed the value of asking for just the last two letters of a call. Doing this cut down the size of the pile by 60%. After making contact, the first thing someone working a DX station should do is *transmit their call* and make sure it's copied correctly by the DX station. Also, don't waste time during a contact asking for routine info such as QSL routes. These items are usually given about every five minutes or so, as we did.

Despite the time out for sightseeing, we worked 4,273 stations in the five days we were on the air. Our log showed 87 countries, 50 states, and all continents. About 57% of our contacts were stateside, with 81% on SSB and 19% on CW. The lion's share of QSOs were on 10 meters (2,838), followed by 15 and 20 meters with 686 each. We averaged slightly over one contact per minute. Conditions were very good, with openings to North America and Europe well into the evening hours.

Planning Your Own DXpedition

We hope you worked VP2EOH. And we invite you to plan *your* DXpedition. It's great fun, and doesn't cost much more than a regular vacation to the same spot. *Being* DX is a great experience. Take it from one who's done it, it's the vacation of a lifetime! Many details must be covered in advance, of course, so plan early to insure a smooth DX operation.

We learned a few other things in the process that may interest DXers.

First, *time your calls*. During big pile-ups, it's tough to pick out calls, so wait a few seconds before transmitting your call. We found that often the tail-ender was the only one we copied.

Next, *listen to the DXer's pattern*. Is each contact just call and report? Or is the DXer collecting QTHs and names? Note what's going on before transmitting. Full calls or last two letters? ■

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73 Review

by Peter H. Putman KT2B

SHF Systems Linear Transverters for 1240 and 2304 MHz

Down East Microwave
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Troy ME 04987
(207) 948-3741
Price Class: $140-$310

Explore the microwave bands with these easy-to-build kits.

One of the biggest obstacles to increasing the amateur population on our microwave bands has been, and continues to be, the lack of ready-made equipment at reasonable prices. Several manufacturers have offered a line of linear transmit and receive converters (known as transverters) that are ready to run out of the box, but at prices that may discourage newcomers.

For those with the technical know-how, the best method has been to "roll your own" equipment, either completely from scratch or from a kit. If you have access to microwave test equipment, this process isn't all that difficult. For those who don't, and who possess only a basic knowledge of microwave operation, it can be an uphill battle all the way with all of the precise assembly and alignment involved!

Things have changed considerably with the advent of microwave monolithic integrated circuits (MMICs) over the past few years. These devices offer broadbanded, no-tune performance with reasonable gain and noise figures at affordable prices. MMICs can be used both as low-power RF gain stages and as RF amplifiers on receive, and they are reasonably stable in operation.

SHF Systems has introduced a line of linear transverters which make extensive use of these devices, along with etched microstrip circuitry. As a result, even the basic kit builder can be up and running on several microwave bands with a minimum of test equipment and time. *[Ed. Note: Down East Microwave is the sole distributor of the SHF Systems kits.]*

The SHF Transverters

Currently, SHF Systems offers transverters for 902 MHz, 1296 MHz, 2304 MHz, and 3456 MHz. In each case, the complete transverter consists of a local oscillator (LO), transmit upconverter, and receive downconverter. All three are located on one PC board on the 902 MHz version. The other three use a separate LO board. Our review versions (SHF-1240 and SHF-2304) are very similar in operation and appearance, although the SHF-2304 transverter board is smaller in size. Both use the same LO circuit, with different crystal frequencies, and both systems use an intermediate frequency (IF) of 144 MHz, making them a natural for use with 2 meter multimode equipment, and even 2 meter FM transceivers.

The key to a stable microwave signal is a stable local oscillator. The SHF-LO employs a 2-stage circuit of BFX89 devices, functioning as a crystal oscillator and buffer amplifier. A series of MMICs and one HP2835 diode multiply the signal into the 540-580 MHz range. Two 3-stage bandpass filters and one low-pass filter ensure a clean signal at the output. An option allows the user 4 dBm more gain (required for the 2304 input).

For 1296 operation, the LO signal is doubled by another HP2835 diode into two more MMICs and associated filters, resulting in an LO injection frequency of 1152 MHz. Both 144 MHz IF ports are coupled to a pair of Wilkenson splitters in a "rat race" mixer scheme. At 2304 MHz, operation is similar except that the 4th harmonic of the LO is selected (2160 MHz) and filtered before injection into the Wilkenson splitter.

Actual TX and RX mixing is performed by a pair of HP2835 diodes on the SHF 1240, while a tiny diode pack of HP-HSMS2822 diodes do the trick at 2304. In either case, there are no tuning adjustments to be made, only some careful soldering when installing these diodes. These mixers are quite sensitive, as only 1 mW of energy at 144 MHz is required for drive.

Both boards are completely symmetrical. This means that either side of the board can be used as a receive or transmit converter, or that both sides could be used for the same purpose. As in the LO, no tuning adjustments are necessary. Depending on the model, different MMICs are used as TX and RX gain stages with 3-pole bandpass filters between the cascaded gain stages.

Although the noise figure performance of the MMICs used is quite good, a GaAsFET preamplifier on the RX side will yield noticeable improvement. Typical power output on both boards is in the range of 10 mW, but higher outputs can be obtained with more drive and LO injection. The RX conversion gain is typically 20-25 dB, more than enough to drive the front end of a 2 meter multimode transceiver.

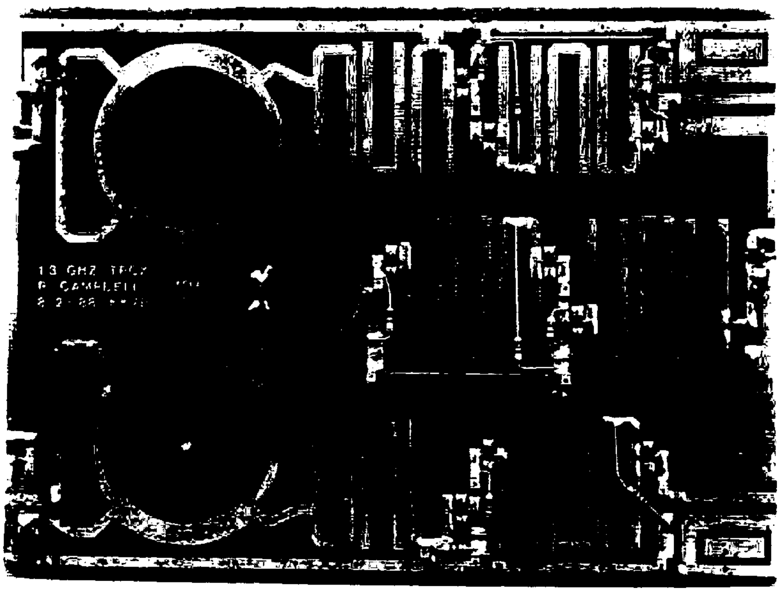

Photo A. The SHF-1240 transverter board (1296 MHz).

Construction

The manual for the SHF LO states that it can be built in under two hours. I took just about two hours to be extra careful, since the case lead identification on the various MMICs can be confusing. For the record, large case MMICS (such as MSA-0404 types) have a dot on the OUTPUT lead, and smaller MMICs (such as the MSA-0685) have it on the INPUT lead. Most cases of trouble with these kits are a result of incorrect lead positioning.

You won't need much test equipment to

check the LO. A simple VOM will do, as you peak the crystal trimmer for current. This will typically be in the range of 200 mA, and a distinct peak will be observed. A 600 MHz or higher frequency counter is handy to verify the actual output frequency while you make this adjustment. An RF millivoltmeter can be used to measure actual LO levels, or a diode probe and FETVOM will suffice for relative output.

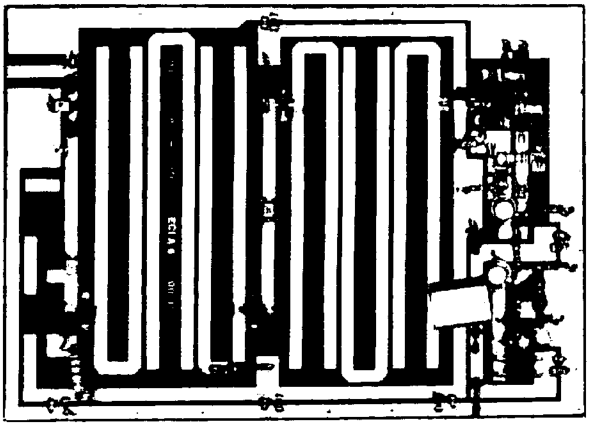

Photo B. The SHF-LO board.

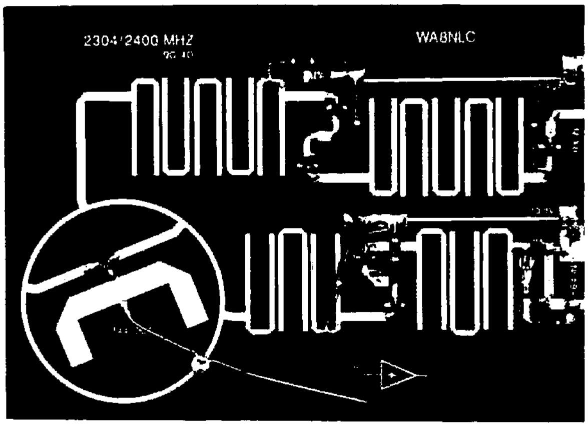

Photo C. SHF 2401K receive converter (for mode S receive).

The transverter boards present varying levels of difficulty. The SHF 1240 version is assembled on G10 epoxy board and can be done in about one hour. The SHF 2304 uses Rogers Duroid material, and all of the grounding holes for each MMIC must be soldered from the top to the bottom ground plane, using copper foil supplied in the kit. This adds about 30 minutes to an hour to the job.

MMIC installation is simple. I suggest cutting the leads prior to soldering, and watch those case dots! Once the MMICs are soldered in, they are very difficult to remove without destroying them. Fortunately, they are also relatively inexpensive ($2–$6, depending on the model), so you won't break the bank if you goof up.

Testing the transverter boards may require nothing more than a sensitive frequency counter on transmit, and another 2304 MHz signal source on receive. Since there's no tuning to be done, the units will either work fine or they won't work at all when powered up! The input power level of 1 mW may be problematic, so the distributor (Down East Microwave) offers a PIN-diode IF switch and attenuator kit as an accessory. This kit can handle up to 3 watts of 144 MHz energy, depending on the resistors installed.

Performance

Both transverters have worked very well here and in portable operations. I soldered the LO to the back of the SHF 1240 board and installed the combination in a Radio Shack metal housing (CAT# 270-272), using BNC connectors for 1296 RX and TX connections as well as 144 MHz In/Out. This chassis also accommodates the PIN diode board. The addition of a Down East 1296 preamplifier and RF power module completes the station, giving me 6 watts output in a small package.

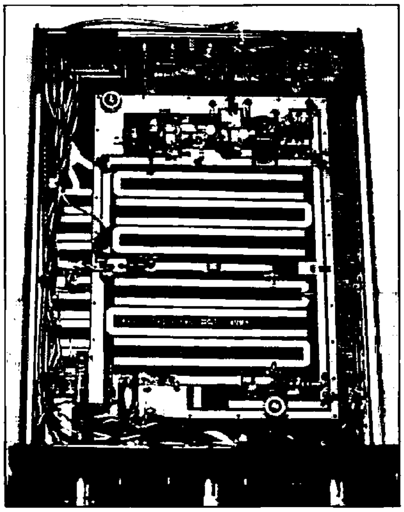

Photo D. The SHF 1240 complete transverter.

The 2304 MHz station was installed in an enclosure sold by Down East Microwave. Again, the LO was soldered to the back of the transverter board. Since this combination is much smaller, I was able to fit it and the PIN diode board into this enclosure. SMA connectors were used at the 2304 RX and TX connections, with a BNC at 144 MHz. Down East sells an inexpensive 2304 GaAsFET preamplifier kit using an Avantek ATF10135 device which was also added. A pair of Frontier Microwave gain stages brought the output up to 2 watts.

I've used the 1296 station twice from mountaintops and it has been extremely reliable over a range of battery voltages, working down into the 11.5 volt level without difficulty. Although the PIN diode board offers a MMIC IF post-amplifier stage as an option, I found it to be unnecessary when used with a Yaesu FT-290RII transceiver. Due to tolerances in the LO crystal used, however, my actual 1296 frequency was off by about −8 kHz from what was displayed.

On 2304, the displayed frequency was much closer, reading low by 5 kHz. Since the 2 watt gain block needs 24 VDC, I use a dual power supply system in the base station. A surplus Microwave Associates 24 VDC SMA relay is also powered by this system. When portable, I use only the first gain stage which needs 12 VDC and develops about 300 mW output, more than enough power when mountaintopping with a 45 element loop yagi.

Other Observations

I can honestly say that these are the easiest microwave kits I've ever assembled. They both worked right off the bat, although the 2304 MHz unit exhibited some instability in the MSA0885 TX output stage. This is due to a downgrading by Avantek of this device from "unconditionally stable" to "conditionally stable" at this frequency. Repositioning a resistor lead to function as a choke cured the problem.

As with any microwave equipment, you'll be working with some very small components, especially the chip capacitors and diode packs. I suggest using a well-lit work area and placing sheets of white typewriter paper under the components to locate them quickly. Doubling over a strip of masking tape on paper and sticking the parts to it until needed works very well.

The documentation for these kits is constantly being upgraded. For 1296, it rates a B+, and is suitable for the builder with basic kit-building experience. Having a knowledgeable ham friend is a plus. For 2304, I give the documentation a C− as it had several errors on a hand-drawn pictorial diagram and showed two resistors connected to the wrong leads on MMICs. Unlike the 1296 kit, no schematics are shown.

Bill Olson of Down East Microwave has made every effort to ensure that buyers of these kits get the correct information when questions do arise—even to the extent of shipping some extra parts gratis, so "factory support" rates an A+. Thanks, Bill!

To summarize, both kits represent a low-cost, low-risk way to become active on microwave frequencies. And you'll have the added benefit of learning a few things about microstrip and surface-mount construction techniques along the way.

The SHF-1240 complete kit, including TX/RX converter and LO board, is priced at $139; the assembled board is $179; the transverter in an enclosure with a PIN diode IF switch is $225. The SHF-2304 complete kit, including TX/RX converter and LO board, is $195; the assembled board $235; complete transverter in an enclosure with a PIN diode IF switch is $310. 73

Hams with Class

Carole Perry WB2MGP
Media Mentors, Inc
P.O. Box 131646
Staten Island NY 10313-0006

Lights, Camera, ATV

One of the fun things about being an instructor of an amateur radio class is that you can never run out of exciting and informative demonstrations to bring into the classroom. The "sparkle" component (see the October 1990 "Hams with Class") of your program is what will have your students remembering the course years after they've completed it.

Since many youngsters today are overstimulated and underworked, they've got to be approached with something of obvious benefit to them right off the bat. Remember always that the way the instructor presents the posed to amateur radio in a fun way.

When the big day came, we weren't disappointed. John WA2QYX, Mike KB2EQQ, Danny N2EHN, Lee WA2JWR, and 12-year-old Walter KB2IOZ provided us with an outstanding experience. John, Mike, and Danny interacted with the children in a thoroughly professional and well-coordinated manner. Their own obvious enjoyment and expertise with this media came through loud and clear. Even passersby on the street were impressed with the way the event was being handled. Lee and Walter worked behind the scenes to make sure everything went smoothly.

The children not only learned about how enjoyable ATV can be, but also about how terrific it is that hams can rely on each other for help, resources, and fun.

Photo A. John, Dan, and Mike setting up the van with ATV equipment for the demo at I.S. #72 in Staten Island, New York.

topic is of critical importance. Children are the best at reacting to a teacher's sense of excitement. If you are genuinely enthusiastic about your presentation, you'll have them at complete attention, anticipating something special. Don't disappoint them. Hit them right up front with what's in it for them.

Recently, I set the stage for a demonstration of amateur TV at my school. The children in my 6th, 7th, and 8th grade ham radio classes have often heard members of the Bayonne Emergency Management Amateur Radio Club on the air discussing ATV. They were looking forward to the morning when my fellow club members would be arriving to set up an ATV demonstration in our school auditorium.

Plenty of Participation

Filled with anticipation, my students quickly spread the word to their other schoolmates and teachers. Before I knew it, I had several requests from other staff members to bring their classes to the auditorium to see the demonstration. Of course, I arranged for the additional seating and enjoyed the idea of non-ham students being ex-

John and Mike KB2GVJ, his son, submitted the following write-up to me. Mike is 14 years-old, and he has been a ham for two years. He loves going along with his dad and the others whenever he can to help demonstrate ATV.

John Anzivino WA2QYX's Report

A television appearance can bring out the "ham" in all of us. Imagine what fun it was to let a group of 6th, 7th, and 8th grade students get into the action. On October 15 several members of the Bayonne Emergency Management Amateur Radio Club, BEMARC, demonstrated the ATV mode of amateur radio to the students of Staten Island Intermediate School #72. Six club members participated in the live TV demo, complete with a fully equipped mobile van and a small downconverter connected to a large-screen TV set in the school auditorium.

Preparation began early in the morning, when John WA2QYX, Mike KB2EQQ, and Danny N2EHN met for coffee near the school. The other two club participants, Lee WA2JWR and his 12-year-old son, Walter KB2IOZ, met them at the school at 8 a.m. The camera equipment, a basic camcorder, was set on a tripod in front of the school. The antenna was a simple 440 MHz vertical. The output of the camcorder was fed into a small 10-watt ATV transmitter, and we were ready to go! A mobile 440 MHz vertical antenna was connected to the downconverter inside the school auditorium, and the output was displayed on the school's large-screen TV set.

Photo B. Mike KB2EQQ stands at the back of the class to watch the ATV demonstration from the viewpoint of the kids.

As the students watched live TV pictures transmitted via amateur radio, the club members explained how easy it is to have fun with your own TV station. Imagine sharing live television pictures all summer long with your friends all over town; doing homework together on two-way television; sharing videotapes of your vacation; showing each other your gifts during the holiday vacation; or putting your parents, brothers, sisters, and the family pet on your own TV show!

During the demonstration, several people walking by on the street were put on television. Most stopped to say hello to the students, and all were impressed with the idea of personal television. The next step was to put some teachers on the screen. We asked one teacher, who teaches a drama class, to come outside and become a star on amateur television. She saw an immediate advantage in ATV for her students. Perhaps we have another prospective ham at I.S. #72.

Finally, we took several students outside and made them ATV stars. The creativity of the students came out in full force. A group of three students said hello to their classmates and told us what they would do with their own amateur TV station. Among the second group of student ATV stars was a budding comic who made the auditorium laugh with his antics and funny faces. When the bell rang, signaling the end of the class period, many students were disappointed; they wanted more ATV action. After the demonstration, many students asked for information on how to get their own amateur radio license. Their teachers explained the school program, and the members of BEMARC promised to return for another television event.

When the BEMARC mobile TV crew arrives at a club meeting site, we usually park the van in a nearby parking lot or other interesting location. If possible, we park on a busy local street and capture people shopping and the colorful scenes in the small store windows. Mike KB2EQQ sets up inside the club.

Photo C. One of the children couldn't resist the opportunity to "ham it up" on TV

He shows all the equipment used for ATV, and removes the covers on the units to explain the function of each board.

We use HTs on simplex for audio between the mobile van and the club meeting room. This way, any club member who has a question for the outside crew can see the mobile member answering over the TV. Full duplex is possible in that manner.

The demonstration starts with the video tape transmitted from the camcorder in the mobile van. Next we switch to live action and show all the outdoor scenes in the area. Before we complete our demonstration, we usually ask some of the club members to come outside and we transmit their picture back to the club.

Since December 1989, our club has completed 14 demonstrations. We've received many comments about our ATV activity, and several more hams have purchased ATV equipment in our area.

If your club is located in the New York City/Northern New Jersey area, and you would like the BEMARC ATV road show, contact our club president, Mike KB2EQQ.

A Coming Attraction

Any instructor who is searching for an innovative and exciting demonstration for the classroom should consider an ATV event. Most schools and clubs today have access to standard video equipment. A basic ATV station consists simply of an ATV transceiver, an antenna, a TV camcorder, a monitor, and a VCR. If you don't have the equipment yourself right now, you can make your desire for a presentation be known to your local radio clubs. Some ham will know of another ham who is involved in ATV. You'll probably be delighted with the response you get. I know you'll be delighted with the reaction you'll get from your audience of students. Amateur TV is a fun way to motivate prospective hams and to capture people's attention.

As a result of the wonderful presentation at our school, five more students had their programs changed so that they could be in the ham radio class. I certainly became convinced of the value of adding ATV to my curriculum. Only a few weeks after the initial ATV demo, our school is well on its way to having its own TV station. Thanks to the generosity of AEA and Mike Lamb, and the help of local hams, we expect to be on the air, seen as well as heard, very soon.

Give it a try and let me know what results you get. ■

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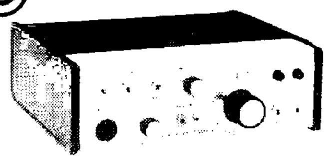

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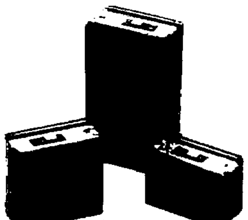

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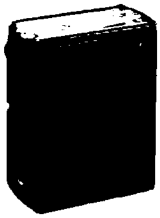

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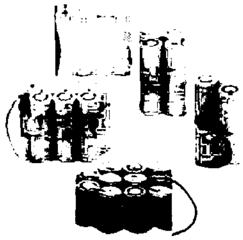

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Pour an Antenna for X-Band

20–20 vision for your microwave system!

by John M. Franke WA4WDL

Ever heard of anyone pouring an antenna? This idea isn't as silly as it sounds, and it's quite easy.

What I am referring to is casting lenses—microwave lenses. It turns out that optical lenses above 3 GHz actually help correct aberrations in the wavefront coming out of a horn antenna, thereby reducing sidelobes. A lens collects and collimates the energy coming out of the horn which results in an increase in gain.

Some time ago, Bill Hoisington K1CLL described a simple X-band (10 GHz) crystal set using a 1N23 detector and a hemisphere of wax as the antenna. (See "The World of X-Band" by Bill Hoisington K1CLL, *73*, March 1975.) He cast ordinary kitchen paraffin to make several short focal length lenses about 0.64cm and 12.7cm in diameter. Paraffin is not optically transparent, but microwaves do not know that. The wax is very clear to microwave energy. Also, the lens surface does not have to be optically smooth. As long as the imperfections are less than an eighth wavelength (0.142 inches), there should not be any noticeable effects. Lenses are much more tolerant of surface errors than are reflector or "dish" antennas. A surface error on a reflector is doubled upon reflection. For example, a tenth-wave bump or dent produces a fifth-wave distortion in the wavefront. A microwave lens with an index of refraction of 1.5 and having a tenth-wave bump or dent produces a wavefront distortion of one-tenth times 1.5 minus 1, or one twentieth wave. In other words, the distortion is less than the physical defect.

Designing and Building the Lens

I can't go into detailed lens design, but I can relate some personal experience in casting lenses. After all, most of us started in microwaves by using dish or horn antennas we found through surplus sales or hamfests. Then, as special needs arose, we designed and constructed custom antennas. The majority of dish and horn antennas used by amateurs fall into the found or purchased category. Few of us actually build them. I have built a couple of special purpose dishes, but will opt for an already-built one any chance I get—I'm basically lazy. (See "The Amazing Cylindrabola" by John M. Franke WA4WDL, *73*, September 1983.)

Several years ago I came across a large glass lens at an antique flea market. I've been keeping it for use as an optical receiver antenna. It is 6 inches in diameter, about 1½ inches thick, and quite heavy. It has a focal length of about 6 inches. The lens is flat on one surface and convex on the other, so it is known as a "planoconvex." Such a large fat lens is poor for optical imaging, but it's a great light collector. However, I needed two antennas. So, I decided to try to cast epoxy resin replicas of the glass lens.

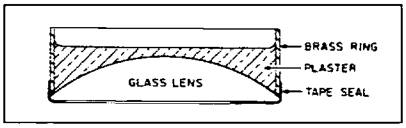

Figure 1. Forming the plaster mold.

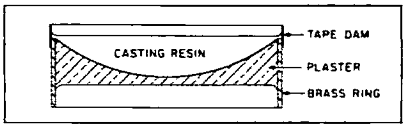

Figure 2. Casting the replica lens.

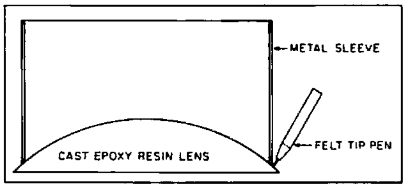

Figure 3. Marking the cast lens for edging. Note that the marking sleeve or cylinder must be perpendicular to this rear surface of the lens.

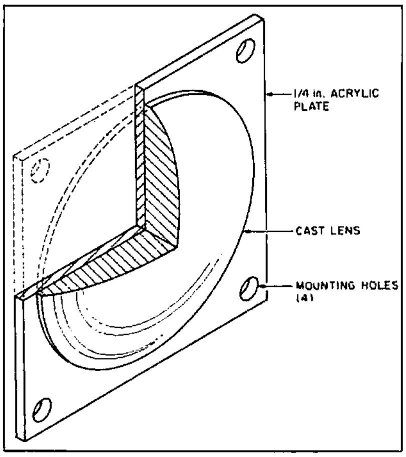

Figure 4. Cast lens epoxied to acrylic support plate.

In my junk box I found a couple of brass rings 6 inches in diameter and 2 inches tall. If I had not had the rings, I could have made suitable rings or sleeves by forming strips of aluminum flashing into a band and taping it to hold its shape. I placed the glass lens on the first ring, curved surface down, then taped the glass to the metal edge with plastic electrical tape, forming a watertight seal. (See Figure 1.)

Next, I mixed plaster, poured it into the mold, and let it harden for several hours. (See Figure 2.) Once the plaster had hardened, I removed the tape, separated the glass lens from the first ring, and taped it to the second ring. Then I poured the second mold and let it harden. (I let both plaster castings dry thoroughly for two days before doing any more work.)

In Photo A you can see several screws protruding through the sides of the brass rings into the plaster. The screws are there to plug existing threaded holes in the rings. They have no other real function, but they may be helpful in holding the ring and plaster mold together.

Once the plaster had dried, it was time to cast the lenses. One mold would have been sufficient, but I wanted to mix the epoxy resin only once. So, I made two molds to have added assurance against having to throw out the mixed resin if I dropped or chipped a mold after the resin was mixed. I placed the molds on a level surface with their smooth cast surfaces up. (If the molds are not level, the rear surfaces of the lenses will be wedged.) A strip of plastic electrical tape was used to form a straight wall lip at the top of each mold. I mixed the hobby casting resin using the least amount of catalyst recommended. This lengthens the curing time, but reduces the

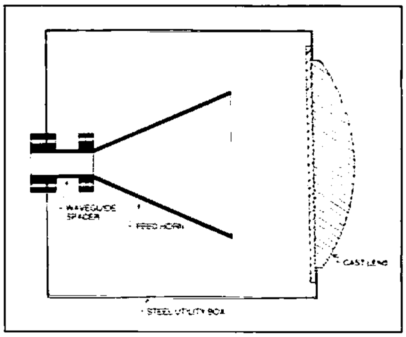

Figure 5. Completed antenna mounted in a 6-inch cube utility box.

chances of uneven curing and cracking due to rapid heat buildup. Next, I poured the resin and allowed it to cure overnight. The curing site should be outside to eliminate any problems with the smelly fumes.

The next day, I separated the cast lenses from their molds. The molds survived and could be used again. The edges of the lenses were rough and chipped, so I decided to trim or "edge" the lenses. I used a cylinder with an outside diameter of 5 inches—the hood from an old oscilloscope—to mark the lenses. (See Figure 3.) The actual edging was done with a disk sander and only took a couple of minutes for each lens. After the edging, the next task was to mount the lenses. Normally, lenses are mounted in a finely-machined barrel with a threaded retaining ring. I can operate a lathe and chase threads, but let's be reasonable! Instead, I epoxied a 5½-inch-square piece of ¼-inch acrylic to the flat surface of each of the epoxy lenses. (See Figure 4.) Then I drilled four mounting holes in each acrylic square.

Light sanding of each lens, followed by a couple of coats of clear acrylic spray, finished the lenses. The sanding is for two reasons. First, although the lenses are of poor optical quality, they can still produce a very hot spot when aimed at the sun, unless their surfaces receive a ground scattering finish. Second, they look better with an even, frosted appearance.

Testing the Lens

One nice thing about small aperture microwave antennas is that you can set up a test range in a short distance. For example, with a small horn source antenna and the cast lenses, a distance of 20 feet is more than adequate. For a source, I used a surplus 2K25 klystron that had its cavity stretched to operate on 10.4 GHz. (See "A Complete X-Band Transmitter" by Stirling M. Olberg W1SNN, *73*, August 1978.) People may shun vacuum tubes, but I can only respect a tube that, like me, is over 40 years old and still working. Besides, have you priced a Gunn diode lately? I would very much like to hear from anyone with a supply of Solfan Gunn diode units. Anyway, the 2K25 puts out about 25mW when used with an old surplus klystron power supply that I got at a hamfest many years ago. The receiving portion of my antenna range is a 0–40 dB attenuator and a tunable detector mount. For metering, I now use a circuit published by Chuck Houghton WB6IGP. (See "Microwave Test Equipment for 10 GHz" by Chuck L. Houghton WB6IGP, *73*, October 1988) I did have to reverse the polarity of the detector diode to get it to work, probably due to a misprint. His circuit is very compact and very sensitive. You cannot go wrong reading his many articles, and he now has a superb column, "Above and Beyond," in *73* every month.

I placed a standard gain horn on both the transmitter source and the receiving setup, and tuned the detector mount for maximum response. Then I set the S-meter to midscale by adjusting the variable attenuator. The attenuator setting at this point became my reference reading. Substituting other antennas on the receiver setup, the attenuator is changed to maintain a midscale meter deflection. The reference reading is subtracted from the new setting. The result is added to the gain of the reference antenna to yield the gain of the new antenna.

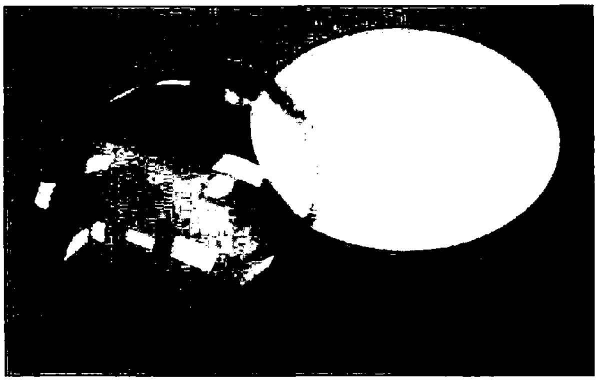

Photo A. Original glass lens and plaster mold.

Photo B. Cast lens epoxied to acrylic plate and lens mounting plate.

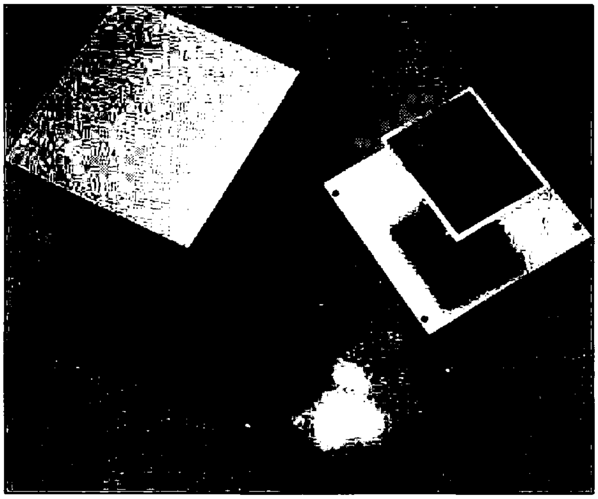

Photo C. Mounted lens, mounted horn and complete antenna.

Sound more complicated than it actually is? Say you have a reference antenna of 16 dB gain and with it you get a reference attenuator setting (reference reading for midscale meter deflection) of 8.5 dB. Putting your test antenna on the receiving setup, you get a midscale meter deflection with the attenuator changed to a setting of 12 dB. Then, subtracting the reference reading (12 − 8.5 = 3.5 dB), you find that the test antenna has a gain 3.5 dB greater than the reference. You have to attenuate the signal from the test antenna to make it equal to the reference signal. The gain of the test antenna is the difference added to the gain of the reference antenna (16 + 3.5 = 19.5 dB). If the midscale deflection had required an attenuator setting of 4 dB for the test antenna, then subtracting the reference reading (4 − 8.5 = -4.5 dB) tells you that the test antenna has a gain of 4.5 dB less than the reference, or a net gain of 16 − 4.5 = 11.5 dB.

You do not need to know the absolute gain of an antenna to use this technique. As long as you use the same antenna as a reference, you can measure the relative gain of your other antennas to it. After all, we are more interested in reducing losses or improving gains than we are in knowing what the absolute levels are.

Back to the lenses. The lenses, having a focal ratio (or F#) of about 1, should be fed with some sort of small horn antenna. I used the only one I had at the time—a Microwave Associates metalized plastic 17 dB gain horn. The addition of the epoxy lens increased the gain by 4.5 dB, or a factor of 2.8. With a unit at each end of a path, the net system gain is 9 dB, allowing the usable separation to be increased by 2.8 for equal signal strength. I was able to mount the lenses on one face of a 6-inch cube steel utility box and mount the horn with a spacer on the opposite face of the box. The result is a compact, easy-to-handle unit that can be readily mounted on a tripod for field work, or on a tower for point-to-point applications. (See Figure 5.)

I am now looking for a larger lens to cast, or perhaps I can find a large bowl to serve as a mold.

Contact John M. Franke WA4WDL at 23 Parkwood Drive, Apt. 201, Yorktown VA 23693.

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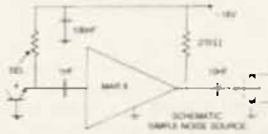
CIRCLE 80 ON READER SERVICE CARD

Need Another

NOISE SOURCE?

It is often desirable to see the performance of RF devices over a large frequency range. Viewing with a medium sensitivity logarithmic system, such as the 107 Spectrum Probe™ or spectrum analyzer, is needed. Finding a signal source is the other problem. A signal generator can be manually varied over the range. This is the most accurate, but it is very slow — especially if band changes and leveling must be adjusted. A swept generator can be used, but viewing is difficult unless the generator frequency is locked to the spectrum analyzer frequency.

FIG. 11



An inexpensive solution is use of a noise source which generates a medium, but essentially constant, level of noise over the frequency range of interest. I designed my own (fig. 11) using the emitter-base diode of the "noisiest" (but constant with frequency) transistor I could find. The diode is reverse biased to break down, with the current adjusted for maximum noise. This is connected to a high-gain wide-band amplifier.

10dB per DIV

100 µV

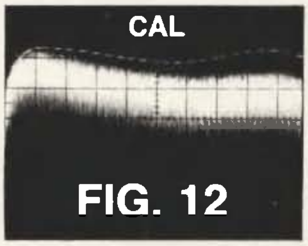


FIG. 12

frequency 100MHz

The Spectrum Probe™ display of fig. 12 shows the noise output, using the coaxial adapter and suitable termination. The noise generator is replaced by a −30dBm/7mv signal generator and this CAL also plotted in fig. 12. The small variation between noise and CAL indicates a nearly constant noise level. A 0.047 µF capacitor across the scope input will reduce the noise bandwidth.

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Dealer's Inquiry invited.

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1200 MHZ
TRI-BAND

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GAIN: 146MHz 2.0dB 446MHz 6.0dB
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POWER: 50 watts
LENGTH: 2'5"
CONNECTOR: N-type

■ CX-630TN
Mobile Fiberglass Antenna
GAIN: 146MHz 2.15dB 446MHz 2.15dB
1200MHz 5.5dB
POWER: 150 W/50 W 1.2GHz
LENGTH: 1'5"
CONNECTOR: N-type

■ CFX-431
Triplexer w/Coax
POWER: 146MHz 800 watts
446MHz 500 watts
CONNECTOR OUTPUT: N-type
146MHz INPUT: UHF
446MHz INPUT: N-type
1200MHz INPUT: N-type

■ CFX-4310
Triplexer w/o Coax
POWER: Same as CFX-431
CONNECTOR OUTPUT: N-type
146MHz INPUT: UHF
446MHz INPUT: UHF
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CIRCLE 54 ON READER SERVICE CARD

The Microwave Directory

Where to find a wide range of goodies for operation at 902 MHz and above.

by Pete Putman KT2B

Ever wondered where to find chip capacitors? Low loss microwave relays? Power dividers? Isolators? Schottky diodes? Or perhaps you need a medium-power gain block to drive the high power amplifier you also need! Or tubes for it. Or even an antenna array. Stymied?

Hopefully, you won't be after reading through this compilation of microwave sources. I've spent a good deal of time rooting out sources for anything from ATC chips to Z-match devices...to help get your next project rolling. While this list is by no means exhaustive, it IS extensive and represents businesses from all over the US and Canada. In most cases, the proprietors are also amateurs, active in a wide variety of microwave operations.

Take a careful look. There are some really neat items available, and all at prices that won't break the bank! Most of these dealers will supply you with a catalog upon request. Each is listed with a brief description of the product(s) sold and any observations I have from past dealings. So, without further delay...

Advanced Receiver Research
PO Box 1242
Burlington CT 06013
(203) 582-9409
VISA/MC accepted

Jay Rusgrove W1VD has been building some beautiful preamplifiers over the years, and makes a nice sequencing board for mast-mounted types. ARR also sells the TR10GA Gunnplexer/Transceiver combination for wideband 10 GHz FM work as well as the TR24GA system for 24 GHz. A line of microwave preamps is in the works. Catalog available.

Bob Seydler
Rt. 2 Box 2170
Boerne TX 78006
(512) 650-3001 Days; (512) 249-2152 Eves.

Bob N5KET and Alan Dickinson N5BHX have accumulated a huge quantity of surplus microwave equipment, ranging from power amplifiers, isolators, Gunn diodes and Gunn oscillators, PLL/DRO oscillators, complete transceivers and components. PHEW! If you can't find it here, then where? Price list available.

Communications Concepts, Inc.
508 Millstone Dr.
Xenia OH 45385
(513) 426-8600

A source of hard-to-find chip caps, RF power transistors, and kits for VHF and UHF. Catalog available.

Distributor Specialists
1942 14th Street
Santa Monica CA 90404
(213) 452-3445

Distributor Specialists carry a full line of high-power relays including Dow-Key Type 60 and 260 series and Marshall CX500 series. Price list available.

Down East Microwave
Box 2310 RR1
Troy ME 04987
(207) 948-3741
VISA/MC accepted

Home of the famous "loopers"! Bill Olson W3HQT is the proprietor, and in addition to loop yagi kits for 903, 1296, and 2304 MHz, he manufactures a line of linear solid-state amplifiers for 903 and 1296. Power levels range from 3 to 70 watts output. In addition, Down East carries the SHF Systems series of transverters for 902 through 5760 MHz. Low noise preamps and kits are available for 432 MHz through 10 GHz. Catalog available.

EMCOM Industries
Ed Emich
10 Howard St.
Buffalo NY 14206
(716) 852-3711

Contact Ed Emich KB2KHK for waveguide and 10 GHz frequency meters. He also can design prototype specialty microwave items for your specific needs.

Frontier Microwave
RD1, Box 467
Ottsville PA 18942
(215) 795-2648 Eves.

Dave Mascaro WA3JUF has been building solid-state gain blocks for quite some time, and offers a line of custom-built amplifiers to cover the spectrum from 902 to 2304 MHz, with power levels from 10 mW to 50 watts. He also builds low-noise preamplifiers for 902 and 1296. They're good for a variety of applications as low-level drivers or final stages. Price list available.

Hamtronics, Inc.
65 Moul Rd.
Hilton NY 14468-9535
(716) 392-9430

A lineup of kits and modules for VHF and UHF including 900 MHz. High quality and economical GaAsFET preamp kits from 10m through 70cm. Catalog available.

Hi-Spec Company
PO Box 387
Jupiter FL 33468
(407) 746-5031

If you're ready to add a bit of power to your microwave signal, Hi-Spec would be a good place to start! A full line of cavity amplifiers is available for 902, 1296 and 2304 MHz. And you can now gang 'em up with the Hi-Spec line of modular RF decks, using a common high voltage supply (yours or theirs). Up to 200 watts out can be obtained on 903 and 1296, with up to 100 watts available on 2304...a potent punch. Price list available.

Microwave Components of Michigan
PO Box 1697
Taylor MI 48180
(313) 753-4581 evenings

Another regular visitor to Dayton! Norm Alred WA8EUU is the proprietor, and he's got quite an assortment of hard-to-find com-

ponents, such as chip and leadless capacitors, chip resistors, microwave diodes, GaAsFET devices, MMICs, piston trimmers and SMA connectors as well as a lineup of Mitsubishi power modules. Norm also builds some nice low-noise preamps from 6m to 1296 MHz. Price list available.

Mountaintop
P.O. Box 178
Somis CA 93066
(805) 482-0320
(Answering machine during daytime or contact directly after 7 pm PST)

John Kitchens NS6X offers a selection of surplus VHF, UHF and microwave parts. He also has MA/COM 10 GHz Gunnplexer systems as well as sideband units for 10 GHz. He still has some of the popular Tonna antenna line in stock.

Pauldon Associates
210 Utica St.
Tonawanda NY 14150
(716) 692-5451

Preamps and power amplifiers for 2m up to 1.2 GHz. Bricks and exciters for 70 cm, 900 MHz and 1.2 GHz. Catalog available.

PC Electronics
2522 Paxson Lane
Arcadia CA 91007
(818) 447-4565
VISA/MC accepted

Always wanted to be TV, eh? Tom W6ORG and Maryann WB6YSS O'Hara can satisfy your craving with a full line of ATV transmitters and accessories for 70cm, 902 and 1296 MHz. Receive converters are also available, and you can even buy the boards to "roll your own" ATV station. Amplifiers and antennas round out the equipment list. Catalog available.

RF Parts
1320 Grand Avenue
San Marcos CA 92069
(619) 744-0728, (800) 854-1927 order line

All kinds of RF power transistors and parts for VHF and beyond. Power modules (bricks) for a variety of bands and input power are available to help simplify amplifier projects. Specialty tubes can be had as well. Catalog available.

Satellite City
2663 County Road I
Moundsville MN
(612) 786-4475
(800) 426-2891

An economical source of 18" and 24" dish antennas as well as Gunnplexers and associated equipment. They also have some real deals on used satellite equipment for FM ATV experiments.

SHF Microwave Parts Co.
7102 W. 500S
La Porte IN 46350

Alan Rutz WA9GKA carries a smorgasbord of equipment for 10 GHz experimenters. Gunnplexers, Gunn diode sources, horns and waveguide are among some of his offerings.

Sinclabs Inc.
Specialty Products Div.
85 Mary St.
Aurora, Ontario, Canada L4G 3G9
(416) 841-0624
In the U.S. contact:
East Coast Amateur Radio
496 McConkey Dr.
Tonawanda NY 14150
(716) 835-8530

For those high-power enthusiasts, Sinclabs produce a nice series of water cooling jackets which mount on a 2C39, 7289 or 7815 tube. Also they offer 900 and 1296 MHz 2-way power splitters. 10m to 2m or 220MHz transverters are available as well. Catalog available.

Spectrum International
P.O. Box 1084-S
Concord MA 01742
(508) 263-2145

For years John Beanland G3BVU/W1 has carried the fine line of Microwave Modules transverters and converters. Although Microwave Modules no longer supply the ham market, he still has some 1296 transverter boards available. He will continue service and repair for any of the units out in the field. John carries a lineup of loop yagis for 1268, 1296 and 1691 MHz as well as a series of high quality interdigital band filters from 420 MHz up to 1691 MHz. ATV channel filters are available designed for specific frequencies. He also offers a wide range of equipment for GOES weather satellite reception on 1691 MHz including a complete high quality system. Look for more interesting transverter packages in the coming year. Catalog available.

SSB Electronics USA
124 Cherrywood Dr.
Mountaintop PA 18707
(717) 868-5643 M-F after 6:30 p.m. Any time on weekends.

Gerry K3MKZ carries the high quality SSB Electronics series of transverters from 6m all the way up to 10 GHz. Also a line of preamps for EME, OSCAR and weak-signal work both mast-mounted or in the shack. A mode S receive converter is available as well. Check out their 100 watt amp for 1200-1300 MHz. A 40-page catalog is available for 85 cents worth of stamps.

Steve Kostro
Box 341A RD1
Frenchtown NJ 08825
(201) 834-1304 9 a.m.-7 p.m.
(201) 996-3584 after 9 p.m.

Steve N2CEI is another "partsmonger" and at hamfests he sets out a tray of components that looks good enough to eat. You'll find all kinds of bipolar and GaAsFET devices available as well as MWA and Avantek MMICs; HP-5082 diodes, chip components, helical filters, connectors and Teflon™ PC board material. Steve also sells a line of GaAsFET kits based on the WB5LUA designs for 902, 1296 and 2304 MHz. Price list available.

Surplus Sales of Nebraska
1315 Jones Street
Omaha NE 68102
(402) 346-4750 or (402) 346-2939FAX
Compuserve 76357,3664
VISA/MC/AMEX accepted

The catalog alone is worth an inquiry! Surplus Sales is a familiar face to Dayton attendees and has an incredible range of new and used parts for sale. It would be impossible to list them all, but items in Catalog #5 of interest to microwave fans include feed-through capacitors, 7289/3CX100 tubes, RF connectors, coaxial relays, attenuators, and power modules. (And I'm only up to page 21!!)

T.D. Systems
2420 Superior Dr. 'B'
Pantego Tx 76013
(817) 861-5864

Steve Franklin WB5KGL has designed a series of AM and FM ATV transmitter and receive modules (along with a video control center) for the 70cm, 900 and 1200 MHz bands. They are designed for mast mounting to eliminate feedline losses. Catalog available.

TE Systems
P.O. Box 25845
Los Angeles CA 90025
(213) 478-0591

A series of medium to high-power amplifiers for the 144, 432 and 1296 MHz bands complete with built-in GaAsFET preamps. Catalog available.

The Antenna Center
505 Oak St.
Calumet MI 49913
(906) 337-5062

A good source of high quality spun dishes specifically designed for high accuracy at the 12 GHz Ku satellite band. These should be great performers on the amateur microwave bands and come in sizes ranging from 2 feet to 6 feet. The 2- and 3-foot models are UPS shippable. Price list available.

The RF Connection
213 N. Frederick Avenue #11
Gaithersburg MD 20877
(301) 840-5477
(800) 783-2666 orders
VISA/MC accepted

If it has anything to do with a connector ...Joel Knoblock probably has "it" somewhere in his vast inventory of connectors, adapters, coaxial cable, switches and relays. Joel is a regular at major hamfests, including Dayton, and has even come out with his own "house brand" type 9913 coax. Price list available.

VHF Communications
280 Tiffany Ave.
Jamestown NY 14701
(716) 664-6345
(800) 752-8813 orders only
VISA/MC/DISCOVER accepted

A source of Hamtronics kits. Price list available.

Continued on page 55

73 Review

by Jeffrey J. Covelli WA8SAJ

The Commander II Amplifier

For more fun on 2 meters.

Command Technologies, Inc.
1117 W. High Street
PO Box 939
Bryan OH 43506
Tel: (800) 736–0443; (419) 636–0443
Price Class: $1388 w/Dow-Key 260-B.
Price Class: $1140 w/o 260-B.

The Commander II amplifier, manufactured by Command Technologies, Inc., is a 2 meter operator's dream come true. It uses a single 3CX-800A7 in a grounded-grid configuration, running in class AB2. The tube itself is capable of 800 watts plate dissipation, which is comforting since the amplifier can put out almost 1000 watts SSB with 25 watts of drive! And all this high power is in a compact, self-contained table-top unit (see Photo A). The amplifier weighs 56 pounds, most of its weight due to the heavy duty transformer used for the 2500-volt, high voltage supply and 12-volt control voltages.

The layout of the amplifier is straightforward and clean. The final amplifier section is in a completely RF-tight enclosure mounted inside the cabinet. It contains the 3CX-800A7 tube with a Teflon™ chimney. The blower is a 50 cfm Dayton squirrel-cage type, which moves plenty of air around the tube, but it won't knock your ears off while running (see Photo B).

Input and Output Circuits

The input circuit is a high Q-tuned type which provides excellent linearity and low SWR for the exciter. I found the tuning to be sharp, though very manageable thanks to the 6:1 vernier gear drive connected to it.

The output circuit uses a quarter-wave stripline design with a high Q piston-type plate tuning capacitor, both of which are machine fabricated of brass then silver-plated. This tuning capacitor moves in and out of a fixed cylinder attached to the stripline. Teflon™ is used for the dielectric, and there is no problem with arc-over since the capacitor is rated at 2–26 pF at 10,000 volts.

Two pre-sprung straps, which give while turning on a screw-type shaft, ground the piston. The tuning capacitor and loading capacitor are connected to 6:1 vernier gear drives for smooth tuning. High voltage enters the plate circuit through a mil-spec "MHV" connector similar to a BNC. Bypassing is done at the connector with a 0.005 µF capacitor at 5 kV, and an open-air type RF plate choke in series with the high voltage lead is attached to the tube by a collar wrapped around the plate. The filament supply is bypassed at the input terminals, and RF chokes are in series with the supply voltages.

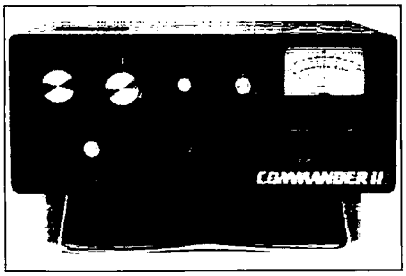

Photo A. The front of the Commander II.

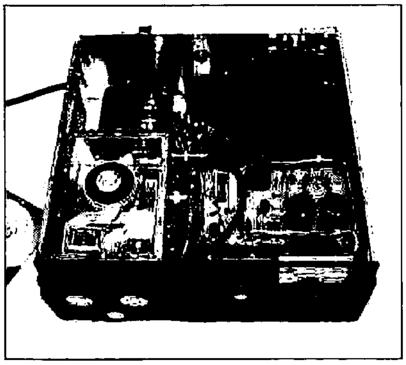
Photo B. Under the cover, a quiet fan keeps things cool.

RF Flow

As the RF leaves the output circuit through the SO-239 connector, it meets a "T" connector, one side having a quarter-wave shorted stub and the other side having a piece of ¼" heliax for the output, which is attached to the Dow-Key 260-B RF relay (the relay is optional; see "Price Class" above). The blower output to the tube is shielded by a stamped-out top cover plate with enough surface area to keep the RF inside; however, there is plenty of air output during operation. The entire RF section uses machine screws and lock-washers to provide excellent RF shielding and grounding.

Typical RF Output Ratings for the Commander II

Watts Drive	Watts Out
5	120
10	320
15	450
25	700

The Power Supply

With all this attention to a highly efficient RF section, the next question that pops up is, where is the power supply? It's in the same compact cabinet as the RF section, but completely separate from it. The Commander II comes wired for 110 VAC, with a large seven-foot #14-3 conductor AC cord. This was a pleasant surprise, and definitely needed to keep the voltage drop down on the primary supply at full output. The amplifier can also be wired for 220 VAC, which I did, and I noticed better regulation as a result.

The filament transformer is not part of the high voltage transformer. This provides for better regulation and no voltage drop at the filaments under full load. The high voltage transformer is large and heavy, 28 pounds worth, exactly half the weight of the amplifier. It sends 900 volts AC to a voltage doubler that generates about 2500 volts DC with 27.5 µF of filtering using eight 220 µF, 450-volt capacitors. A 50-ohm, 50-watt resistor in series with the high voltage lead limits the current in the event of a short or flashover in the tube.

A single meter switched in and out using a multiple pole switch mounted with a small PC board on the back, provides plate voltage, plate current, and most importantly, grid current. The control board, mounted on top of the high voltage board, gives the two-minute time delay needed for the cathode of the tube to warm up before operation can begin. The regulated 12 volts for relay control, and a zener diode for proper class AB2 bias, are also a part of this board.

Operating the Commander II

The operation of the Commander II is very easy. When you turn on the amplifier to warm it up, the meter's lamp lights up and high voltage is present on the plate of the tube. The green lamp will come on when the two-minute

delay circuit is complete, and at that point the amplifier is ready to go.

The 12-volt relay circuit requires a hard contact closure to ground rated at 150 mA of current draw. When you key the amplifier without drive, the plate current reads about 120 mA, and the grid current should be zero. I found no erratic plate or grid current readings at this point while tuning the plate and load controls along with the input tuning. This means the amplifier is very stable and won't go into oscillation while the drive is still at zero.

The nominal input drive is 10 to 15 watts, while 25 watts is maximum. As seen by the table, even 5 watts will give over 100 watts output. This amplifier really runs well. I found its efficiency at about 60% or better, depending on the drive. Wiring the amplifier for 220 VAC resulted in better regulation, with about a 150-volt drop in the high voltage supply at full output. If you have a dedicated line for the amplifier, it can run fine at 110 VAC, drawing close to 14 amps at full output.

Easy to Tune

Overall, tuning is straightforward. For the most part you are looking for maximum output while checking to make sure the grid and plate currents are not exceeded. I used a Bird Model 43 with various elements, up to 1000 watts for all tests. My own station consisted of a multimode Yaesu FT-901DM, with the FTV-901R transverter at 15 watts for some of the testing; and a multimode Yaesu FT-736R VHF and UHF rig at 25 watts for the high power testing.

My transverter only had 15 watts, but even at that level my output was still 450+ watts! With the 25 watts from the FT-736R, this amplifier really puts out the power—at least 700 watts! And if you really watch the grid/plate current and don't exceed maximum ratings, you can get almost 1000 watts power SSB.

On-the-air checks while running SSB were all very good, and I had no bad reports of audio distortion or splatter up and down the band. In fact, most people commented on how good the amplifier sounded! Putting the amplifier in and out of the line was fun, since the gain difference is about 15 dB! And that's really handy when trying for that extra grid square on 2 meters.

I also run plenty of FM simplex with key-down times of 5 to 10 minutes for each "go-around" during an entire evening. There has been no problem with the amplifier as long as I keep the power output around 400 to 450 watts. Don't let it get any higher than that on FM unless you want to purchase a new tube soon! After having the opportunity to run this kind of high power on 2 meters for the past couple of months, I see a whole new world open up.

Most of the rigs today have good receivers, but unless there is something such as the Commander II in the output, the score is not even. I was always hearing very well, but now I can work anything that comes through on the receiver!

One final note: I am really glad to see an all-American company producing such a well-made piece of equipment! 73

Continued from page 53

Wyman Research, Inc.
R.R. #1, Box 95
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Well . . .there you have it. Again, the list is by no means exhaustive! Surely there are more entrepreneurs out there peddling microwave components at hamfests than I know about. And, of course, I purposefully omitted the major manufacturers who already heavily advertise their microwave products, such as transceivers and preamplifiers for 23 centimeters.

Clip this article out (or put this issue aside) to use the next time you come up against a wall when searching for parts or whole assemblies. Amateurs are supposed to be a resourceful lot. Above 900 MHz, you haven't much choice! This will make the job easier.

See you on 902 . . . 1296 . . . 2304 . . . 3456 . . . 5760 . . . 10368 . . . etc. . . . 73

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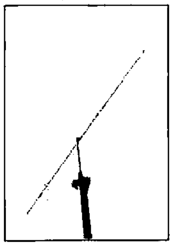

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HOMING IN

Radio Direction Finding

Joe Moell, PE, KØOV
PO Box 2508
Fullerton CA 92633

Leveling the Field

In Radio Direction Finding (RDF) contests, as in every other sport, it's important for winners to be determined by fair and uniform methods. One of the students in our local beginners' ham class is a former world class ice dancer. He has told us horror stories of the subjective scoring system for competitions. Standings are determined by a panel of judges, and "hype" appears to be as much a factor as talent and skill in winning the gold.

Fortunately, foxhunt winners aren't picked that way. We can use objective criteria for scoring. But which criteria to use and how to apply them can lead to controversy. It's important for all hunters to feel that they have a fair chance of winning, or they won't participate regularly.

And...They're Off!

An obvious method for selecting T-hunt winners is to use a watch. Everyone starts hunting simultaneously, and the first finder wins. Easy, right?

This method is the favorite of the "sportsman" type of hunter, as well as those who view foxhunting primarily as practice for jammer hunts or search/rescue missions, where speed is all important.

But many foxhunters abhor time-only hunts. "These hunts favor the athletic hunters and the daredevils," they say. In an on-foot hunt, a participant with a physical disability is at a disadvantage. In vehicle hunts, time factors discourage safe, courteous driving skills. Other hunters may be willing to push the speed limit. Are you?

The biggest complaints about time hunts arise when locals and out-of-town hunters face off. Traditionally, San Diego (California) hunts are always time-only events. When San Diego hams host a big convention and put on a T-hunt, many Los Angeles and Santa Barbara area attendees gripe about the likelihood of the San Diego teams winning all the prizes, because they know the fastest routes on the local freeways and highways. Of course, these gripers usually don't participate in that hunt, so it becomes a self-fulfilling prophecy.

Maintaining interest on a long timed hunt can be difficult. If the hider lets it slip out that at least one team has found the T, the other hunters know that they cannot win. They may quit at that point and go home, unless the hider can keep them going by baiting them, promising them snacks, etc.

Some club rules allow hunters to start anywhere, perhaps on a hilltop close to their home. Almost always, these are time-only hunts. Of course, there is an element of luck involved, because some hunters will start much closer to the T than others.

Another problem occurs when teams get the same start bearing and follow one another. It's bad enough when it causes a drag race on a vehicle hunt, but it's even worse when foot-hunting. The first finder must be careful not to give away the location of a concealed T to others who are sniffing nearby.

World class foot-hunt competitions often use a "staggered start" to avoid this problem. Competitors start at regular intervals, and each of them is independently timed from start to finish. That's fine for a European radiosport championship, where there are plenty of judges available to do the timing, but it's impractical for small club outings when everyone wants to hunt and no one wants the timing chores.

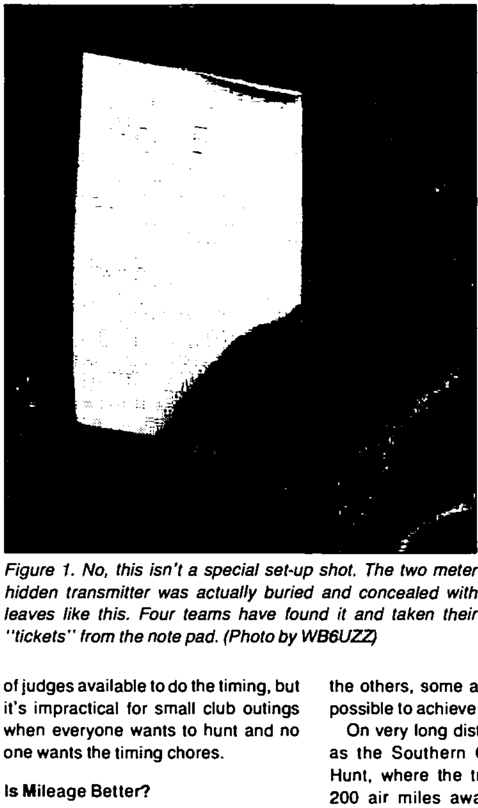

Figure 1. No, this isn't a special set-up shot. The two meter hidden transmitter was actually buried and concealed with leaves like this. Four teams have found it and taken their "tickets" from the note pad. (Photo by WB6UZZ)

Is Mileage Better?

Of the 15 monthly hunts in the greater Los Angeles area, only three use time as the sole factor for winning. The rest use mileage, either as the only factor or the most important factor. Using odometer mileage eliminates racing and timing problems. It helps level the field for new competitors, who are less familiar with local geography and the operation of their RDF gear.

Eliminating time as a factor encourages hunters to be careful and methodical. Mileage hunts are preferred by "engineer" types (like me) who view a T-hunt as a field experiment in propagation and navigation, instead of as a blood sport.

Mileage hunts can be almost as simple as timed hunts. Odometers are read at the beginning and the end point. The lowest mileage wins. Traffic tie-ups, poorly-timed stop lights, long freight trains, and open drawbridges don't ruin your day on a mileage-only hunt.

Mileage hunts have their own problems, however. Some hunters take advantage of the lack of a time penalty and hunt v-e-r-y slowly, perhaps stopping for leisurely meals along the way. Needless to say, this is very annoying to the hider, who wonders when he or she will get to go home.

If an on-foot search is involved at the end of a mileage hunt, it's easy for some lazy or poorly equipped teams to hang around and watch someone else try to ferret out a carefully concealed transmitter (see Photo A), instead of going after it themselves. After all, they found the parking area, so their place in the finishing order has already been determined by their mileage. There is no incentive to dig out the sniffing gear.

What's Your Crenshaw?

The biggest problem with mileage-only hunts is odometer calibration.

Whenever teams finish with mileages a percent or two apart, there will be controversy. I am told that continuing odometer arguments led to the San Diego hunters changing to time-only hunts. One or two teams always had significantly lower mileages than the others, some appearing to be impossible to achieve by any route.

On very long distance events, such as the Southern California All Day Hunt, where the transmitter is often 200 air miles away, a five percent odometer error (quite common) frequently changes the order of finish. That is why a standard method for normalizing mileages was devised. It's called the Crenshaw Factor, because each hunter calibrates his odometer by driving a carefully-defined section of Crenshaw Boulevard on the way to the starting point.

Hunters read their odometers with the nose of the vehicle alongside a telephone booth in front of a certain doughnut shop, then drive in the left lane to the stop sign at the starting hilltop and read it again. The elapsed mileage is the vehicle's Crenshaw Factor, usually about nine miles.

It takes only a few seconds with a calculator to determine the winner of a close hunt with Crenshaw Factors. Just divide each hunter's odometer hunt mileage by his or her Crenshaw Factor. The results, in Crenshaw Units, are compared. The winner has the lowest number. Some hunters don't like results to be expressed in Crenshaw Units, so they multiply the Crenshaw Units by 9.0 to get approximate corrected mileages.

That explanation may seem a bit complicated, but actually it's very simple and quick to do. "What's your Crenshaw?" is being heard at the end of hunts quite often, even the shorter ones. There are far fewer disputes, merely occasional snide comments about the "inflation" of claimed Crenshaw Factors over time.

Pick Your Combination

Mileage-only and time-only hunts each have good and bad features, as we have seen. This has led many clubs to adopt rules that include both time and mileage factors, trying to get the best of both worlds.

Most Fullerton (California) Radio Club hunters like their system, where the final score is the sum of odometer mileage, plus a time penalty of one-tenth mile per minute from start to touching the fox's antenna. Lowest hunter's score wins, of course. This system encourages careful triangulation and route planning, while also keeping the hunters moving along and forcing rapid sniffing. On the other hand, some feel that the time penalty turns this hunt into a road race.

Some clubs have additional methods of scoring that include keeping track of the progress of all participants over the course of the annual foxhunting season. In Lincoln, Nebraska, the first finder of each hunt gets 15 points, second gets 10, third seven, and so on. All participants, including navigators, get at least one point.

Even the hider scores in the Lincoln ARC system. He or she gets five points if not found in 30 minutes, and additional five points for each unfound 15 minutes after that, up to 25 points. Cumulative standings are updated monthly and posted in the club newsletter.

To make hunting more of a challenge in the flatlands of Nebraska, foxes transmit for two minutes, then are silent for three minutes. The hider uses the high power mode on the rig until one hunter requests a switch to low power. From there on, each transmission is one minute at high power and one minute at low power, to aid hunters who use rudimentary attenuation methods.

Now that you know the pros and cons of various scoring systems, your group can make up its own set of rules. Get started now, because the warm weather hunting season will be here soon. Be sure to take pictures of your group's most interesting RDF setups and clever fox dens. I am always looking for good photos and interesting hunt stories for this column.

Number 16 on your Feedback card

An Inexpensive 10 GHz Dish System

The plumber's delight!

by Jerry Jensen WTØW

This design for a 10 GHz dish and feed system was born of necessity. There are few sources of microwave components here in the Midwest, so construction projects have to use available non-microwave parts. The only microwave part used for this system is one WR90 waveguide flange. Even that could be made of scrap material if you can't locate one easily.

The dish is an old 18″ surplus HBO dish left over from the days when premium channels were broadcast. It has a focal ratio of 0.4, providing a focal length of about 8.1″. The dish I found has a 1″ hole, conveniently located at its center, that permits the 10 GHz source to be mounted behind the dish and fed through it to a modified "penny feed." A chassis punch or drill could be used to make the hole on a solid dish. One of the old "flying saucer" dish snow sleds would also work if you modify the feed's length to meet the new focal ratio.

The feed system starts out as a 12″ piece of ¾″ copper pipe. Anneal one end of the pipe by heating about 2″ of the end until the surface looks very clean (don't get it red hot), then plunging the hot end into cold water. This will make the annealed end of the pipe very soft and easy to work. Place about ½″ of the end in a vise and squeeze the pipe with the vise until the pipe is an ellipse about ½″ wide. Next, rotate the pipe 90 degrees and do the same thing, but stop at 1″, at right angles to the first squeeze. By repeating the operation a few times, you will end up with an end on the pipe that fits the WR90 flange. Pliers and careful hammer tapping (with a sharp right angle piece of steel held inside the pipe) will make the corners of the squeezed pipe perfect. Be careful not to strike the copper hard enough to stretch it or you will end up with too large an opening.

Once the end of the pipe matches the flange, force a ¾″ outside pipe coupling (just a copper tube that fits over the joint of two ¾″ pipes) down the pipe to as near the flange end as possible. This will act as a spacer for the next plumbing piece, a 1″ male pipe threaded to a 1″ copper pipe adapter. Put the adapter over the pipe coupling with the male threaded end away from the waveguide flange. Some adapters fit over the coupling tightly, others are a bit sloppy. A layer of clean copper wire can be wrapped around the coupling, or a single turn used at the end(s) for spacers as needed.

Before the assembly is soldered, mount a 1″ galvanized pipe flange on the back of the dish over the 1″ feed hole in the center. Screw the copper adapter about halfway into the flange and measure the length of the pipe sticking into the dish. Check to be sure that the end of the pipe goes into the dish at least far enough to be within an inch of the focal point. If everything checks out, solder the waveguide flange to the pipe and the pipe coupling and adapter assembly. If you get any solder inside the end of the waveguide at the flange, use a small file to remove it.

Screw the feed assembly about halfway into the pipe flange, mark and then cut the copper pipe to make it about 1½″ short of the focal point.

At this point there is an option. If you want to be able to tear down the system into its most portable state for backpacking or such, you can make the splash feed removable. This will allow you to pull the feed system out of the dish. The feed system and splash plate can then be packed inside the dish.

The splash plate assembly is made from a male ¾″ pipe threaded to a ¾″ copper pipe adapter, a PVC (plastic) ¾″ female pipe threaded to a pipe adapter, and a 3¼″ copper disk. The PVC adapter is epoxied to the center of the copper disk. This is then screwed on to the pipe thread of the ¾″ copper adapter and the disk. For a completely portable system, drill and tap the copper adapter for a set screw to hold it to the feed system (an extra nut soldered to the outside might be wise). For fixed operation, solder the copper adapter to the radiating end of the feed system.

Tune Up

Tune up is simple: The radiating end of the feed has to be set to the dish's focal point. Then the separation between the end of the waveguide and the splash plate is adjusted for maximum radiation.

You will need some sort of power or signal strength measuring device to make these adjustments. It can be as simple as an unpowered Solfan unit. Just measure the mixer diode current of the unpowered unit when it is placed a few feet away from the dish with a sensitive current meter. Another Gunn transceiver could also be used to peak the signals.

The feed system can be adjusted by screwing the assembly into or out of the dish. The splash plate can be adjusted by screwing the PVC adapter further on or off the ¾″ pipe thread. These adjustments interact and should be made to optimize the gain of the system.

If you have built the portable system with set screws, be very careful not to distort the ¾″ copper pipe waveguide when you tighten the screws. If everything has been done correctly, the polarization of the output will be within a few degrees of the original source. If small dents or distortions are introduced into the pipe, the polarization of the output will rotate.

An 8-32 screw can be inserted into the center of the copper disk and adjusted to scatter the RF energy better as it hits the disk. The copper disk can be made from a piece of single or double-sided PC board. The PVC adapter could be machined from a better microwave plastic for lower losses. During the machining, a dielectric lens structure could be formed to optimize the scatter from the disk.

This disk and feed system may not be perfect, but it is a usable system that can be made from hardware store plumbing parts. Total cost, without the dish, should be less than $5. The feed illumination is good, and there is very little measurable radiation escaping the dish. Measurements taken across the dish (built with the dimensions shown) show a reasonable illumination pattern. 73

Contact Arthur J. (Jerry) Jensen WTØW at 10900 Ewing Ave. S., Bloomington MN 55431.

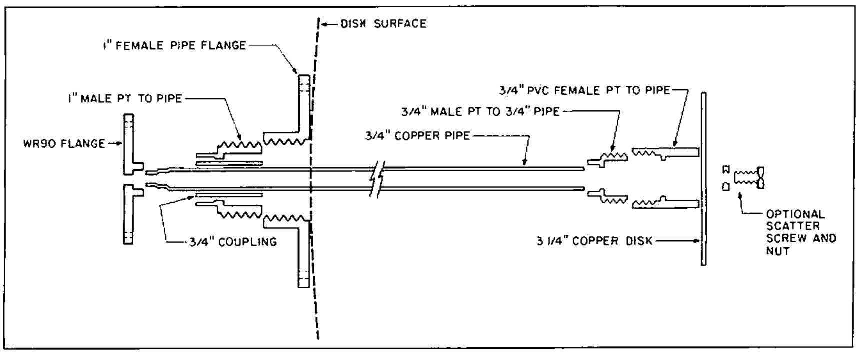

Figure 1. Assembly of the 10 GHz dish and feed.

Parts List

1	12″ length of ¾″ copper water pipe
1	¾″ male pipe thread to ¾″ pipe adapter
1	¾″ female—female pipe coupling
1	¾″ PVC female pipe thread to PVC pipe adapter
1	1″ copper male pipe thread to pipe adapter
1	1″ galvanized iron female pipe flange
1	WR90 waveguide flange
1	3¼″ copper brass disk

Note: 18″ and 24″ dishes are available from Satellite City, 2663 County Road I, Moundview MN; (612) 786-4475. Costs are about $20 and $30 respectively.

Number 17 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

Microwave Mixers

There are so many different types of microwave detectors available that I couldn't fully describe them all to you. What I will do is describe some of the more common types I've observed in surplus, the most familiar being the double balanced mixer (DBM) that's similar to the SRA-1. I have used this mixer in many different converters. You'll find various applications for it in almost any ARRL handbook.

Most devices run out of steam at 500 MHz; some special types, such as the TFM-1, are capable of operation up to 1500 MHz. But for our microwave bands, we need mixers that operate at frequencies from 2.3 GHz to 10 GHz and above.

Some prepackaged microwave mixers come with coaxial connectors attached to their three ports: RF (in/out), IF (in/out), and local oscillator, L.O., injection. Yes, that's "in/out," as any mixer can be used in receiving or transmitting. Mixer ports are labeled R (for RF), L (for L.O.), and X (for IF). Package styles can vary quite a bit. Usually, but not always, the bigger the package, the lower the frequency.

An SSB Modulator

At a flea market, I found a device labeled "SSB Modulator" that was 3½" high, 5" long, and ½" thick. (See Figure 1.) Quite a monster as mixers go. The price was right, so I picked it up. I thought it would be a 500 to 1.5 GHz low frequency mixer of some type, but when I tested it, it failed to perform at these frequencies. I opened it up to see what was going on.

Access to the inner parts was hampered by bolts epoxied and painted over. After scraping the paint off and picking the epoxy away with a knife, I was able to remove the bolts. The unit split into two sections (top and bottom plates), revealing the inner circuitry.

Looking at the circuitry, I could see it wasn't defective. The device was a very high frequency phase combining type of mixer. The actual mixer circuitry was about ¾" square, definitely not 1 GHz stuff. I put the unit back together and tested it at a much higher frequency, and found that it functioned in the 8 to 12 GHz range.

It's difficult to represent all the details of this mixer, but it uses four diodes and has combining striplines on both the top and bottom of the very thin PC board, coupling and phase canceling RF from port to port. This method achieves a high degree of balance, improving unwanted mixer products from either the USB or LSB inputs. Needless to say, I was excited.

If an item is inexpensive, take a gamble and pick it up; you do not know what you might be missing. True, the mixer could well have been another doorstop, but no gamble, no chance of winning.

Another type of mixer common on the surplus market is waveguide mixers. You can identify their frequency by the size of the attached waveguide. Figure 2 shows a typical waveguide mixer. This unit has two mixer diodes and usually comes with an internal preamplifier optimized around 70 MHz. This is a common IF for commercial systems. One of the waveguide ports is the RF input and the other is the local oscillator injection for the mixer. I have interchanged them with no ill effect.

Two caps about ½" in diameter allow you to service the detector diodes, if necessary. Note that this mixer only uses two diodes; one is positive and the other diode is reversed in polarity. The circuit works just like a full-wave rectifier in an AC/DC power supply.

Testing microwave detector diodes is simple, as they have a standard junction and will test like a basic diode. One problem is that the voltage rating and current permitted through these microwave diodes is quite low, and in testing them, use caution not to exceed limits. The old reliable 1N21 (6 GHz) and 1N23 (10 GHz) diodes used can be tested with a basic ohmmeter. Use the times 10 scale to limit current, and it will show you if the junction is still alive. This will not guarantee any figure of merit (noise figure) of the device. If the device is a good noise-figure type, you might want to wait until you can test it in a circuit.

I would not want to subject expensive diodes to the ohmmeter test. You must use good judgement, since some of the newer devices, such as GaAs types, will be destroyed or degraded by test voltages near 5 volts. I would limit the meter test to the 1N21 and 1N23 diodes. The GaAs type mixers have static-sensitive junctions and can easily self-destruct with improper handling. Test GaAs devices in a circuit, after the device is built, not with the ohmmeter.

A mixer similar to the waveguide type operates at lower frequencies. The waveguide may not be attached because a larger size is required. Normally, the waveguide ports are replaced with two "N" connectors on the opposite side from the detector diode caps. The basic body contains the same IF type amplifier described above. See Figure 3, which describes a mixer for 5.6 or 3.3 GHz operation. These mixers come from aircraft radar and some communications systems. Several variations are starting to appear in surplus.

The "ortho mode" waveguide mixer (see Figure 4) takes a totally different approach by coupling the RF and L.O. ports in a unique way. This mixer is waveguide orientated, with the RF port rotated 90 degrees from the L.O. port. This further isolates the ports. (Normal isolation between cross polarization is a minimum 30 dB loss). The IF amplifier could be bolted to the mixer, but usually the mixer is by itself. IF connections are made to both the detector diodes, one positive and the other reversed or negative. If you have one of these mixers, you can combine the detector diodes with two coupling capacitors to form the IF output. Don't forget to provide a DC return for the mixers. A small RFC will do the trick.

Now you might ask, "Why all the information on these mixers?" Well, they work and they're relatively inexpensive, costing about $10 to $20 each in surplus. You can use them to construct a high quality SSB or narrowband FM microwave converter. They may not be the latest state-of-the-art mixers, but they will work as well as the expensive types. Size is the only drawback.

Mixer Perspective

Of course there are several other types of mixers suitable for our microwave bands in addition to the types described. These can be single-balanced, double-balanced, quadrature IF, image rejection, rat race, and even triple balanced types. Mixers are rated by conversion loss and noise figure. Conversion loss is the ratio of RF input power compared to the IF output power. Noise figure, expressed in decibels, is the ratio of signal to noise. The lower the decibel value, the better the mixer will perform in receiving weak signals.

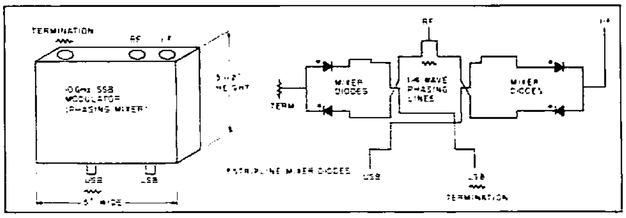

Figure 1. Surplus SSB modulator for 10 GHz.

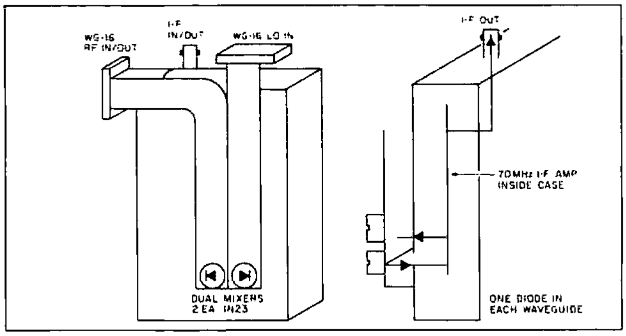

Figure 2. Waveguide mixer for 10 GHz.

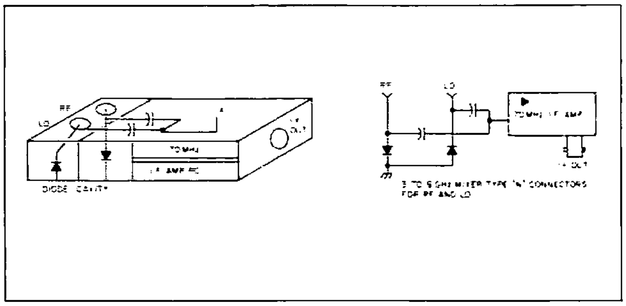

Figure 3. Mixer for 3–6 GHz range.

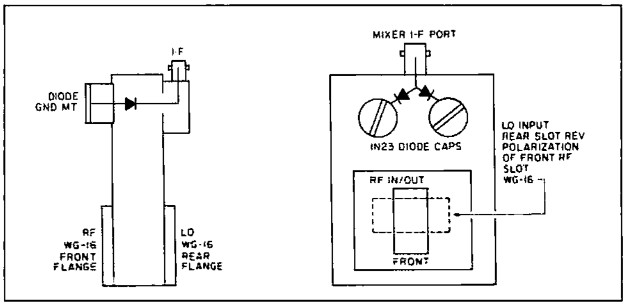

Figure 4. The ortho mode mixer 10 GHz (good for SSB 10 GHz), inexpensive in surplus, has good port isolation.

```
Listing 1.

FORMULA FOR GUIDE WAVELENGTH (FREE SPACE)

 3  REM PROGRAM CALCULATES GUIDE WAVELENGTH
 7  REM IN A WAVEGUIDE ENTER DIMENSION IN
 8  REM INCHES EXAMPLE WG16=.9 INCHES
 9  REM ENTER FREQUENCY IN MHZ
10  INPUT "FREQUENCY";F
20  INPUT "DIMENSION A";A
22  X=300000/F
24  Z=25.4 * A
30  B=2 * Z
40  C=X/B
50  D=C^2
60  E=SQR(1-D)
70  G=X/E
80  PRINT G
90  GOTO 10
```

Listing 1. Free space calculation for guide wavelength.

```
Listing 2.

SAME PROGRAM FOR GUIDE WAVELENGTH BUT CORRECTED FOR SEA LEVEL
ATMOSPHERIC CONSIDERATIONS AND ADDED "ABS" STATEMENT TO CORRECT
FOR SOME COMPUTERS' METHOD OF HANDLING NEGATIVE / LESS THAN ONE

2 REM CONSTANT CORRECTED FOR SEA LEVEL
3 REM AND STANDARD HUMIDITY (299780)
5 REM PROGRAM CALCULATES GUIDE WAVE
6 REM LENGTH IN FRACTIONAL INCHES
8 REM DIMENSION A=INSIDE WAVEGUIDE
9 REM EXAMPLE WG/16 = .9 INCH
10 INPUT "DIMENSION A";A
20 INPUT "FREQUENCY";F
22 X=299780/F
24 PRINT X

26 Z=25.4*A
30 B=2*Z
40 C=X/B
50 D=C^2
52 H=1-D
53 PRINT H
55 H=ABS(H)
60 E=SQR(H)
70 G=X/E
80 PRINT G
84 I=G/25.4
86 PRINT I
90 INPUT "DO YOU WANT MORE DATA";Z$
100 IF LEFT$ (Z$,1)="Y" THEN 20
110 END
```

Listing 2. Guide wavelength program corrected for sea level.

```
Listing 3.

PROGRAM FOR DIELECTRIC CONSTANT OF PRINTED CIRCUIT BOARD

 2 REM THIS PROGRAM CALCULATES THE
 4 REM DIELECTRIC CONSTANT OF DOUBLE
 6 REM SIDED PC BOARD BY MEASURING THE
 7 REM CAPACITANCE IN PF, AND MEASURING
 8 REM THE SQUARE INCHES OF THE MATERIAL
10 INPUT "distance between plates";D
20 INPUT "measured capacitance";C
30 INPUT "square area in inches":A
40 X=.224*A
50 K=D*C/X
60 PRINT "dielectric constant";K
70 INPUT "DO YOU HAVE MORE DATA";Z$
80 IF LEFT$ (Z$,1)="Y" THEN 20
90 END
```

Listing 3. Dielectric constant calculation for PC boards.

Keep looking at flea markets and swap meets. Don't turn up your nose at some old grubby box with a waveguide mixer weighing half a pound and covered with spider webs. Check it out. I usually tell friends: If it's microwave and the price is low, buy it.

Listings 1–3

Larry K1LPS inspired the program listings in this column. In designing Gunn oscillators and detector mounts, he wondered, "Just how far from the back of the cavity do you space the diode or pick up in a transition?"

The dimension is a quarter of a wavelength, however the measurement is abraded by the fact that it travels differently in a waveguide than in free space. Therefore, it is spaced a "guide wavelength" (one-quarter guide wavelength, actually).

I worked the formulas out, but usually came up with different answers. In the process of doing my math I make "misteaks"! Therefore, I put the formulas in a basic program that can run on almost any computer. The programs are short and can be typed in quickly. See Listing 1 for the free space calculation for guide wavelength, and Listing 2 for a corrected formula for sea level/humidity corrections. This program also corrects for computers like the Radio Shack Model 100 that can't take the square root of a negative number.

The program in Listing 3 is for figuring the dielectric constant of a double-sided printed circuit board. All you have to do is measure the capacity of the PCB, figure how many square inches of material you have, and enter it into the program. After a few calculations, you can make a chart to take to flea markets to determine if you are looking at Teflon™ or Fiberglas™ material.

From the Mailbox

Curt WA6TIP asks about the mike transformer, capacitor C34, and the value of the meter movement used in the 30 MHz IF system in the article, "10 GHz Fun," in the April 1990 issue. Well, Curt, the mike transformer matches the impedance of your mike (assuming dynamic) low Z, to the high impedance of the mike circuit. Mine was about 2k to 50k, a surplus type. In the article, pins 2 and 3 of the mike circuit were erroneously reversed. Pin 2 should go to the decoupling network and feedback resistor, and pin 3 ties to the mike circuit. Sorry about that.

Alternatively, you could replace the transformer with an electret mike (99¢ at Radio Shack). Convert the circuit by tying one end of the electret mike to pin 3 and the other end to ground, and couple a 15k resistor at pin 3 to +DC. Capacitor C34 was left off the parts list; it's a 10 µF bypass, noncritical. The meter movement was a sensitive-type 25 microamps. You can use any type of meter up to about 200 microamps.

Next, a letter from Jeffry N0MAU. He wanted to determine just how expensive it is to get on the 2 or 3 GHz bands. I believe it would cost about a hundred dollars for a kit of parts along with some good scrounging. That's why I am pulling for 10 GHz operation. You can get 10 GHz equipment inexpensively by scrounging local alarm companies for microwave alarm units. Alarm companies are tossing out microwave units in favor of newer systems. That would make a simple system for 10 GHz cost effective. The total cost of a simple system could be less than $40 if you scrounge parts.

Gary KD6RF wants to know if the PC board for the 30 MHz IF amplifier is still available, and if the price has gone up. Well, everything is going up, especially gasoline, but my price remains the same. Cost is still $10 for the PC board with the TDA-7000 chip, and a few other parts to help you defray costs. (See "10 GHz Fun.") I try to keep all items available to assist project building, as I feel this is a very necessary ingredient to promote low cost projects for our UHF/VHF microwave frequencies.

New developments in my shack include working on several laser related projects, and I'm looking for a few parts, especially head-on photomultipliers to use in an optical receiver. Already built is a unique circuit for the receiver, which I'll cover in a future column. I've built a diode detector, but I want to try the photomultiplier tubes out next because they are more sensitive. I would appreciate any help or information on a source of these tubes.

I'll be glad to answer any questions related to our VHF/UHF microwave bands or similar topics. Please send an SASE for prompt reply. Chuck WB6IGP 73

UPDATES

10 GHz Fun

Chuck Houghton's article, "10 GHz Fun," appeared in the April 1990 issue of *73*. See his "Above and Beyond" column, page 59, in this present issue for corrections. He states that in the article, pins 2 and 3 of the mike circuit were erroneously reversed. Pin 2 should go to the decoupling network and feedback resistor, and pin 3 ties to the mike circuit. 73

IT JUST NEVER OCCURED TO ME TO APPLY FOR A RECIPROCAL LICENCE BEFORE I CAME!

Dx

Number 18 on your Feedback card

Hams Around the World

Bob Winn W5KNE
% ORZ DX
PO Box 832205
Richardson TX 75083

Germany and Yemen

Germany: The ARRL Awards Committee has accepted the following recommendations of the DX Advisory Committee:

Effective October 3, 1990, the German Democratic Republic, Y2 through Y9, is deleted, because that country was absorbed by the Federal Republic of Germany on that date. Contacts with Y2 through Y9 stations on or after October 3, and contacts with DA through DL stations on or after September 17, 1973, will be credited as contacts with the Federal Republic of Germany.

The committee doesn't mention the former East German stations with callsigns in the DM series; however, the official allocation for the Federal Republic of Germany is DA through DR, not DA through DL.

Yemen: Effective May 22, 1990, the People's Democratic Republic of Yemen, 7O, and the Yemen Arab Republic, 4W, are deleted. In their place, a new country, Yemen, 7O, is added effective the same date. March 1, 1991, has been set as the earliest date for submission of cards for credit for the new Yemen listing. Please do not submit cards for credit prior to that date. Honor Roll members who have made contact with Yemen since May 22, 1990, will be able to update their credits during the month of March 1991, prior to publication of the next Honor Roll listing.

DXCC Processing Backlog

In late October 1990, the ARRL staff, faced with a large backlog in processing DXCC applications, organized a special effort to speed things up. ARRL Business Manager Barry Shelley temporarily took charge, applying what he'd learned in banking, where daily processing of numerous transactions is commonplace.

Other new assignments at ARRL headquarters also helped to reduce the backlog. By early November, applications received in June 1990 were being processed, a delay of approximately five months. As the new process gains momentum, the delay should be steadily reduced to an acceptable period.

"Islands On The Air" Award Program

Possibly one of the many good things about DXing is the chance to learn world geography. The Islands On The Air (IOTA) Award program goes one step further. It gives you a reason to learn about the world's islands, many of which would otherwise go virtually unnoticed.

Shortwave listener Geoff Watts created the IOTA Award program in the 1960s, when he began to wonder what DXers would do when they had worked all of the DXCC countries. For almost six months, Geoff spent two days each week surrounded by atlases and naval charts, listing, identifying, and grouping islands and archipelagos by continent.

The first IOTA contacts were credited on December 1, 1964, the day the *IOTA Directory* was first published. Today, this award program, consisting of 16 separate awards based on numbers of islands contacted and world location, is administered by Roger Balister G3KMA and the IOTA committee. You can obtain information about IOTA's award program and a copy of the island *Directory* from Roger Balister G3KMA, La Quinta, Mimbridge, Chobham, Woking, Surrey GU24 8AR, England. The price is US$4.00 or 7 IRCs in Europe; US$5.00 or 9 IRCs outside of Europe. ■

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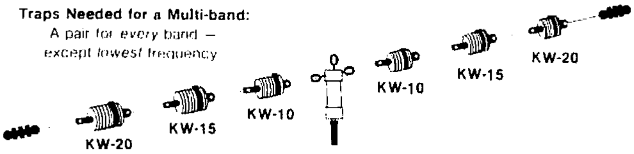

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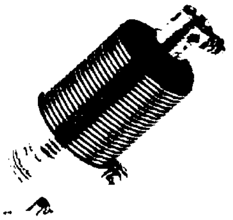

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KW-10		10	28.675
KW-12		12	24.950
KW-15		15	21.275
KW-17	NEW	17	18.118
KW-20		20	14.175
KW-30		30	10.125
KW-40		40	7.250
KW-80F		80F	3.875

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3D2AA	via SM2BFJ
4S7EF	effective Oct. 18 via N1HBF
4U1ITU	1990 CQWW phone via OK3LZ
4U1ITU	Ocl. 20, 1990 op was KGYK
4U45UN	(4U1UN) via NA2K
5W1JF	via WB6OKK
5W1JJ	via K6VNX
5W1TD	via W6MKB
5W1XD	via W6XD
6D2X	via KD5GY
6I2A	via XE2AQ
7Z1AB	1990 CO WW phone only via KN2N *Callbook* address; others now via WB2WOW
8P9X	via K4FJ
9H8C	via PAØVAJ
9J2FR	via I2ZZU
9M6OO	via N2OO
9Y4H	via *Callbook* address
A35DM	via ON4QM
A71CD	PO Box 80074 Al-Wakr, Qatar
AY9F	via LU9FHF
CN2CW	via F2CW
CN2JO	via F1MJ op was F6ATO
CN8YP	via F6FYP
CN8VV	via F6EEM
CQ9M	via G3PFS
CR2UW	via CT4UW
CT3EU	via G3PFS
CV2V	via CX4CB
CY9CF	via FP5DX 1990 *Callbook* address
D68GA	via N6ZV
D68VT	via K5VT
ED4CW	EA4CW, Jose Ricardo López PO Box 28067 28080-Madrid, Spain
ES2WX	PO Box 13 Viimsi 203006 Estonia, USSR
FK8GJ	via F6CXJ
FOØSSJ	via K8JRK
FO8AA	via N6VO for North America
FY5FP	via ON4ZD
GP6UW	via G3XTT
HC2G	via HC2CG
HD1T	via W2KF
HX6DMX	via French bureau
IJ8MAS	via IK8ISH
J37DX	via W8KKF
J37V	via K8CV
JY9SR	Ray Shankweiler, Box 354 Amman, Jordan
K9EL/VS6	via K9EL
KHØAM	via JE1CKA
L8H	via LU4HH
LP3F	via LU6FAZ
LZ1V	via LZ1KZM
PY1QN/PQ8	via PY1QN
R3R	via RA3RQT
SV5A	via SV1AIH
T3ØF	via OH6ZS
T3ØJH	Box 299 Ryde, NSW 2112 Australia
TA5KA	via HAØNNN
TP2CE	November 2–4: via F6FQK
TY1DX	via IK6FHG
TY2A	Box 40 I-61100 Pesaro, Italy
UH8EA	now via W5BWA
V47KP	via K2DOX
V47NS	via W9NSZ
V63BD	via VE3JDO
V63DX	via JA7HMZ
V73AZ	via KX6DC *Callbook* address
V85OM	via N2OO
VP2MEU	via K8UE
VP5VWB	via WD8RIH
VP5VMA	via WD8LLD
W6TEX/CT3	via W6TEX
XX9KA	via KC9V
XU8DX	via JA1NUT use oversize envelope
YJ1A	via OH3GZ
YM5KA	via HAØNNN
ZS9/W6KG	same as C9OL
ZS9Z	via ZS6BCR
ZS9Z/ZS1	via OH2BH

QRP

Number 19 on your Feedback card

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

A Station T/R Controller

Last month I mentioned a project every QRPer should have in the shack: a station T/R controller. This month we'll take a look at what is needed to accomplish this task.

When I started working on the station controller, I had to design it to work in anyone's station; to be able to mate with and control the vast amount of receivers on the market, without knowing the requirements for muting or antenna changeover. This controller uses relay switching to control the external devices. I chose relays for several simple reasons: They're cheap, easy to come by, and they totally isolate the logic from the external device. I've included a parts list for all major components, with Radio Shack part numbers. Of course, you don't have to get your parts from Radio Shack; junk box parts will do quite nicely. In fact, the board layout is very flexible. You can use either radial or axial capacitors for the two large electrolytic capacitors listed.

To make things even better, I've joined forces with FAR Circuits to produce circuit boards for this column (see the parts list for address).

The T/R controller should be looked at as four different circuits. This will make troubleshooting easier, should the need arise. The four circuits consist of the following: sidetone generator, audio amplifier, delay switching and keying, and power conditioning. To better understand how the T/R controller works, a short description might help. We'll start with the power conditioning part of the controller.

Parts List

1	741 op amp	RS 276-007
1	LM386 amplifier	RS 276-1731
4	2N2222	or RS 276-2009
1	2N3905	or RS 276-2023
4	1N4001	RS 276-1101
1	1N914	RS 276-1122
1	5k PC trimmer	RS 271-217
1	100k PC trimmer	RS 271-220
	or 100k panel pot	RS 271-092
1	10k PC trimmer	RS 271-218
	or 10k panel pot	RS 271-1721
1	4700 µF cap	RS 272-1022
1	1000 µF cap	RS 272-958
	or 1000 µF	RS 272-1047
1	470 µF	RS 272-1030
	or use 470 µF	RS 272-1018
1	0.1 cap	RS 272-135
1	47 µF	RS 272-1027
1	10 µF	RS 272-1025
2	PC mount relays	RS 275-219
1	reed relay	RS 275-233
1	metal enclosure	RS 270-272

Miscellaneous parts include resistors, small capacitors, PC board, IC sockets, connectors, knobs, LEDs, wire, antenna relay (a good choice would be RS 275-218), and other odds and ends.

A blank PC board is available for $6.50 + $1.50 postage/handling from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Power Conditioning Circuit

Being solar powered, my station is a bit different from the usual ham shack. A large battery bank supplies power to the shack. Because of the nature of this setup, I have to decouple any 12-volt device from the 12-volt bus. In the T/R controller, the decoupling is in the form of a large electrolytic capacitor.

To provide reverse voltage protection to the T/R controller, a small 1N4001 diode is in series with the supply line. You might worry about the diode surviving the inrush of current to charge the capacitor, but this shouldn't be a problem. If you can't sleep at night thinking about it, use a 3-amp diode in place of the 1N4001.

If you connect up the T/R controller backwards, nothing will happen, and there will be no damage. After this diode comes the 4700 µF capacitor. You may not need that much capacitance. In fact, one of the T/R controllers I plan on using in a transceiver has only 2200 µF of capacitance. Use what you need to keep critters off of the +12 volt bus, but don't lose any sleep if you can't find the exact amount listed here. The value is not critical. I supply operating power for the T/R controller from my +12 volt power bus.

As a second thought, you can use a wall transformer to power the T/R controller, as long as the unit can supply +12 volts with at least 500 mA. The large 4700 µF cap will smooth out even the nastiest wall transformer power supply. You may even be able to get by with an AC powered wall transformer, as the diode will rectify this and the 4700 µF cap will then act as a large filter cap. This is not the best route to take, but it *should* work. A 470-ohm resistor and LED are included to let you know the T/R controller has power applied to it.

Four LEDs keep you informed on what is happening with the T/R controller. There is one each for "power on," CW keying, delay, and "audio on." I used TP1 LEDs in my prototypes. These are very bright and look nice in the case I chose to use.

The Sidetone Generator

I used a 741 op amp to generate the tone, with a PC mounted trimmer to adjust the pitch. You can adjust it to your liking. This tone generator is turned on and off to follow the keying. I did not want to keep the tone generator running all the time, since this could cause trouble if the high gain audio stages of a direct conversion receiver were to pick it up. The result would be a constant tone in the receiver. The tone generator is keyed on by applying +12 volts to the sidetone input.

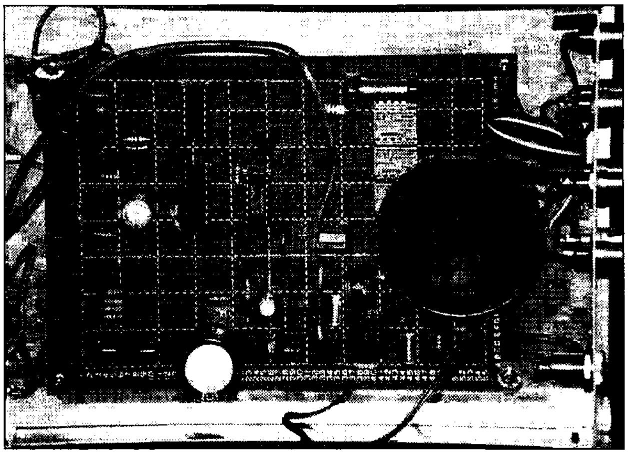

Photo A. Inside of the prototype of the T/R controller. Notice the four relays; one is hidden under the speaker. Also, note the three extra ICs for the keying delay circuit. This was not included in the final circuit.

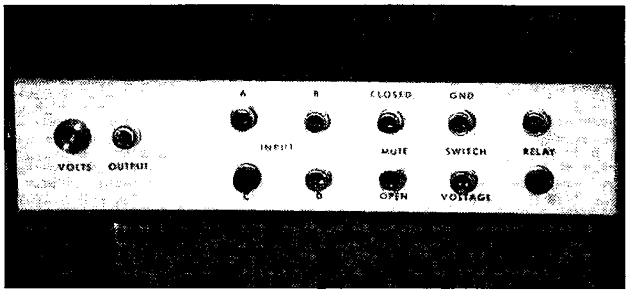

Photo B. Rear view of the T/R controller in a Radio Shack chassis.

The Audio Amplifier

The audio amplifier takes the low-level sidetone and provides speaker level audio. This is a classic design using an LM386 audio amplifier chip. Notice the second 1000 µF capacitor near the LM386. Don't forget to include this capacitor; it keeps the LM386 happy.

You may either use the PC mounted trimmer to adjust the volume of the sidetone, or a panel mounted control, as I did. If you decide to panel-mount the volume control, just run the wires to the PC holes used for the trimmer. Use small shielded cable. A set of holes is included on the board to turn off the audio amplifier. If you want to keep the audio on all the time, jumper these pads together and just turn the volume down. I added this feature just in case your keyer has a built-in sidetone.

Delay Keying

Though the final product is simple, cheap, and efficient, I had to do some real soul searching on the design of the delay keying. In the photographs of the prototype, you'll notice several extra IC chips. These were used to add a 25 ms delay to the transmitter. The idea was to turn the relays on, let the contacts stop bouncing, and then turn the transmitter on. The prototype worked quite well, but I was also getting reports of missed first characters. By the time I fixed that problem, I had practically no delay left, so why include it?

The delay circuit is fast (this depends on the type of relay used) and extremely easy to build. When the key is closed, transistor Q2 is turned on. This supplies +12 volts for several circuits. First, if you connect the sidetone out to sidetone in, you provide keying voltage for the sidetone generator. Second, transistor Q3 is turned on. This grounds the reed relay, keying the transmitter. An LED is also keyed along with the relay.

While all this is happening, +12 volts is applied to the 47 µF capacitor via the 1N914 diode. This turns on Q4 and Q5, activating the two on-board relays. Notice that the contacts of each of these relays are not connected in any particular way. This is one of the benefits of the T/R controller: complete versatility. One relay will control an external antenna relay and the other will mute the receiver. The contacts of both relays are rated at 5 amps. You can use one of the relays, if need be, to control a 110 volt AC antenna coaxial relay. However, if you do this, use EXTREME CAUTION since you'll be exposing yourself to the full line voltage on the back of the board.

You might also want to move the relays off the board. This might be the case if you can't find, or don't want to spend, the money for Radio Shack relays. If this is so, connect the coils to the proper pad of the T/R board. Mount the relay and use the contacts to your liking. A 4PDT relay can be used with no trouble if you don't mind the rat's nest of wires coming from the contacts.

In small QRP projects, you might even be able to get away with running the antenna through the on-board relay. There is minimum RF bypassing

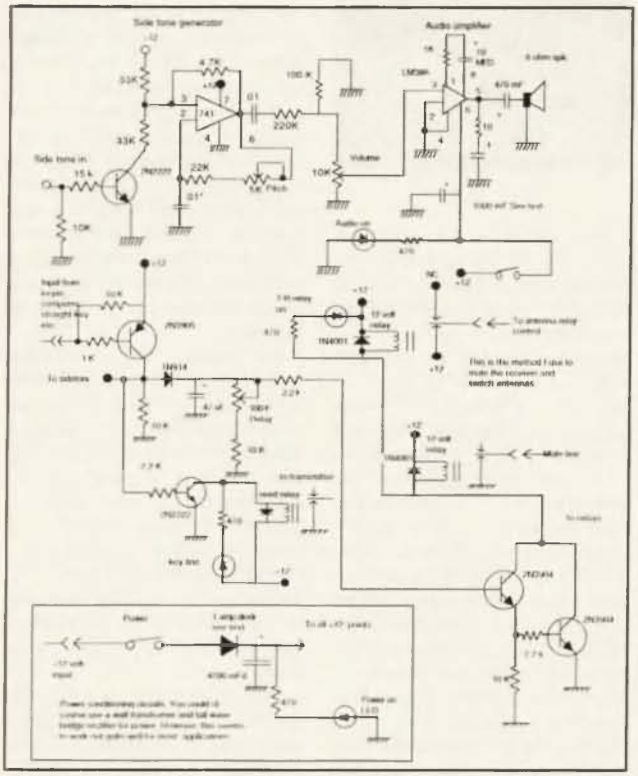

Figure 1. Schematic for the T/R controller.

on the board. You might have to add some 0.01 and 100 pF caps on the input lines to keep RF from getting into the circuit.

Start to Finish

The T/R controller is best built in sections. The first place to start is with the power conditioning components. Stuff the components for the sidetone and audio amplifier second. After checking over your work, connect an 8-ohm speaker to the output terminals. Set both the pitch control and the volume control to mid-range. Apply power to the controller. *Make sure the audio power is turned on via the PC pads.*

If you installed the power-on LED, it should be on. Use a clip lead and apply +12 volts (get this from the + side of the 4700 µF capacitor) to the sidetone in the terminal. If all is working, you'll hear a tone from the speaker. Remove power from the board. Finish stuffing the rest of the board.

Set the delay control to mid-range. Apply power to the board. Ground the key input terminal. The relays should pull in and the T/R LED should be on. Remove the clip lead from the key-in terminal. After a short delay (determined by the setting of the delay control), the relays should drop out and the LED should go dark. Key the terminal on and off with the clip lead. This should make the reed relay also turn on and off, following the keying from the terminal. The CW LED should also follow the keying. Use a small wire and connect the sidetone out to sidetone in terminals together. Again, ground the key input. The sidetone should sound, relays pull in, and reed relay follow the keying.

If you connect your keyer, straight key, computer or whatever to the key in the terminal, grounding this point will turn on the T/R controller. I used a six-position switch to select six different inputs from the front panel on my T/R controller. Not only do you get total automatic T/R control, but the added convenience of keyer selection, too.

Antenna Connection

Perhaps the most difficult part of building the T/R controller will be deciding how to connect it up to the rest of the equipment. Primary consideration will be in the antenna switching. I use a second relay (from the junk box; if purchased, a good choice would be a Radio Shack 275-218) in a small aluminum box. The box is mounted in an out-of-the-way place with a control cable connecting the antenna switching relay to the T/R controller via a two-conductor cable.

This box contains SO-239 connectors and RCA jacks, so I can use both or either type of connector on the end of the cables from the antenna, receiver, and transmitter. The relay contacts switch from receiver to transmitter. The control voltage is +12, supplied from the T/R controller. One of the on-board relay supplies switched +12 volts to the antenna control relay.

The second on-board relay mutes the receiver. My receiver needed the mute line isolated from ground to receive. To mute the receiver, you mute the line to ground. Now you can see why the contacts of the relay have been left uncommitted. I use RCA jacks on the back of the T/R controller, and just pick the ones that I need.

Well, that's about all the space this month. Now that you have a T/R controller, perhaps next month we'll have something to control. Don't unplug the soldering iron just yet.

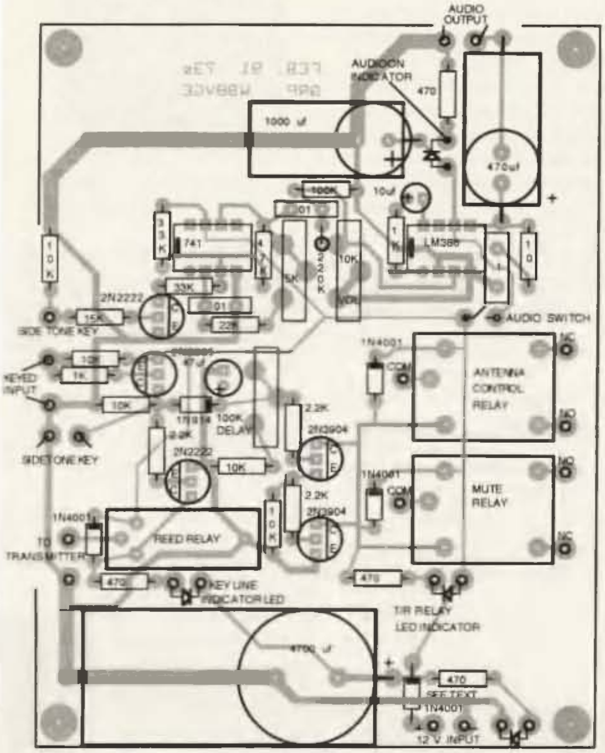

Figure 2. Parts placement.

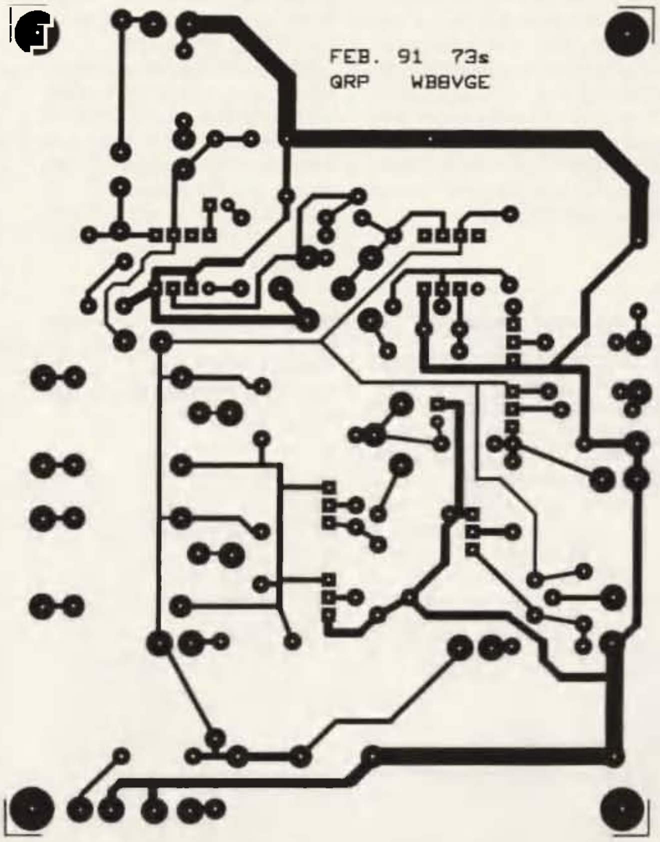

Figure 3. Foil diagram.

NEW PRODUCTS

Compiled by Hope Currier

AEA

The PC-Pakratt II has finally arrived! This program replaces the popular PC-Pakratt program for IBM compatible computers. It is a powerful program that takes advantage of AEA's exclusive Host Mode, and offers full Host Mode support for the latest PK-232 command set. PC-Pakratt II works with IBM AT & XT compatible computers, with or without a mouse. The program includes the latest version of AEA's PK-FAX program, offers a full QSO logging feature and a DOS gateway, and it can save and restore all 18K of PakMail messages to disk. Its other features include user-friendly help screens, macro facility, complete parameter screens, and quick access to the user's word processor. PC-Pakratt II very closely resembles the original program, so current users should find it relatively quick and easy to make the switch.

If you already own the original PC-Pakratt, regardless of when you purchased it, you are eligible for a $40 discount off the suggested retail price of $70 for the new program. For more information contact *Advanced Electronic Applications, Inc., P.O. Box C2160, Bldg. O & P—2006 196th SW, Lynwood WA 98036-0918; (206) 775-7373, Upgrade Hot Line: (206) 774-1722.* Or Circle Reader Service No. 201.

ASHTON ITC

Ashton ITC has announced a new communications software product called SCORPIO (Shortwave Computer Operated Radio Plus Input/Output). Designed for the sophisticated shortwave listener and monitor, SCORPIO breaks new ground by combining intelligent scanning, based on a flexible database search, with simultaneous automated digital signal decoding and data capture. It can be interfaced with ICOM and Kenwood computer-ready receivers, plus RS-232 all mode terminal units such as those manufactured by AEA, Kantronics, MFJ, Tonno and others.

SCORPIO makes it easy to build databases (log files) which can Include a received station's identification, location, frequency, mode, time of operation, agency or type of service, signal level, date heard and any pertinent remarks. These databases may contain thousands of entries and may be sorted and searched by any category. An *AutoLog* function can even record "hits" to disk during a scan, and convert the resultant file to a database.

SCORPIO includes a comprehensive User's Guide and a sample database containing 100 of the most popular HF utility and SW broadcast frequencies. It sells for $90. Contact *Ashton ITC, P.O. Box 830, Dandridge TN 37725; (615) 397-0742.* Or circle Reader Service No. 205.

J•COMM

J•Comm has introduced a new audio filter for use by amateur radio operators and SWLs, the MagicNotch™. This is an automatic audio notch filter designed to instantly remove heterodyne QRM from SSB reception. It effectively reduces interference caused by negligent operators tuning on or near the frequency, CW signals,or other carriers. The MagicNotch filter is also very useful in reducing the effects of computer generated RFI, which is becoming an important source of heterodynes in the ham shack today. No tuning of the filter is required. When interference of a constant frequency is detected by the control circuitry, the internal switched capacitor active filter (SCAF) is automatically tuned to that frequency, effectively reducing the interference by up to 40 dB. The filter will continue to track any variation in the frequency of the interference until it disappears. The width of the notch is extremely narrow so there is no noticeable degradation in the quality of normal speech signals. The filter activates in less than one second. In many cases, the operator may not even be aware that a carrier has appeared. Operation of the filter is indicated by a two color LED which turns red when an interfering signal is locked in.

No modifications to existing equipment are necessary. The filter operates on the audio output from the receiver as obtained from the external speaker output. The built-in 2 watt amplifier is sufficient to drive any 8 ohm speaker. The filter is powered by 10–14 volts DC, which is usually obtained from the accessory connector of the rig. The compact 5.5" x 3" x 1.5" unit is housed in a gray and blue aluminum enclosure.

The introductory price is $100, plus $5 S&H. Contact your nearest dealer, or *J•COMM, P.O. Box 194, Ben Lomond CA 95005-0194; (408) 336–3503.* Or circle Reader Service No. 203.

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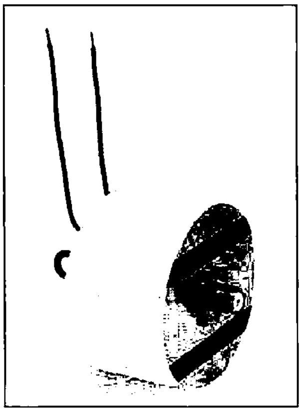

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ASK KABOOM

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Amateur Radio Today
WGE Center
Forest Road
Hancock NH 03449

Why Rigs Sound the Way They Do

One favorite topic you can hear on any ham band at just about any hour is the good ol' "How's my rig sound?" Sometimes it seems like an obsession, surpassed only by the local weather and OTH.

Why are we so concerned about how our radios sound? Well, for one thing, it comes from the tradition of home-brewing. Remember, there was a time, not all that long ago, when we hams built our own stations. Not only was the transmitted audio quality a point of pride, it was also a legal concern. Bandwidth limits had to be observed, and you couldn't count on Kenwood to ensure you weren't breaking the law because of excessive high frequency response or distortion.

Today, of course, home-built stations are rare, at least on this side of the now-rusty iron curtain. Yet we continue to discuss and adjust our audio, trying different mikes and level settings, all the while striving vainly for that "perfect" sound. What we often overlook, however, is that the sound of a rig is dependent upon far more than its microphone, and in fact may be inherent in the radio itself. More than anything else, the modulation mode (AM, SSB, FM) and the method used to achieve it determine the limits of audio quality. But let's start where the audio signal starts: the mike.

Speak Into the Transducer, Sonny

Yes, your microphone's characteristics do have a great influence on your audio.

There are four types of mikes in common use:

Crystal mikes depend on the piezoelectric effect to generate a voltage by flexing a crystal. They have a high impedance (50k ohms or more) and are mostly found with older tube gear. The mikes are somewhat tinny and harsh sounding. Sometimes, the effect can result in excellent "punch" on SSB. Unfortunately, crystal mikes also have a limited life, and the old one you got with that hamfest special may be shot. The symptom of a bad one is *extremely* tinny or distorted audio, bordering on the unintelligible. Many an hour has been lost fruitlessly tracing signals through perfectly good audio stages when the real problem was a bad crystal mike.

Ceramic mikes are similar to the crystal units except that they are less likely to fail with age, and they are a bit less tinny. Although not in common use, they can be great with tube gear, and even used successfully with solid-state gear, as long as there's a matching transformer between the mike and the rig. Some exotic headset-type mikes use ceramic elements to great advantage.

Dynamic mikes are built somewhat like small speakers. They have permanent magnets and voice coils. The difference is that they are used in the generator mode; the output from the voice coil results from the sound waves striking the diaphragm.

These mikes are inherently low-impedance, and produce far less output than their piezoelectric cousins. Some have small matching transformers in their cabinets for high-impedance use. Dynamic mikes are pretty rugged, and rarely ever fail.

Their sound is quite a bit less tinny than that from the crystal or ceramic types, but it still has a rising frequency characteristic. That is, the voltage output of the mike rises with the audio frequency. Until a few years ago, mobile HF rigs and most VHF units came equipped with dynamic mikes.

Electret condenser mikes have the smoothest frequency response of all. They use a permanently-charged diaphragm (the "electret") between two electrodes, in a capacitor-like arrangement. The minute changes in capacitance which result from the diaphragm's flexing can be detected with an FET preamp and converted into an audio signal. In fact, most condenser mikes have the preamps built right into their tiny cases! Even with the circuitry, they are the smallest mikes around. Because their diaphragms don't have to push against anything, they don't need much mass. (That's also the reason for the great frequency response.)

Because of their flat frequency response, these mikes sound very natural, and high-precision versions are often used in studio recording. Natural voice quality is not the same thing as maximum intelligibility, though. In fact, a somewhat tinny mike gets through HF QRM better than a natural, smooth condenser mike. Despite this, most new rigs come with condenser mikes because they are small and inexpensive. With some equalization, though, they can sound fine on the air. Some radios incorporate the EO into their speech amps.

By the way, all condenser mikes require DC power to run the preamps. Some have small batteries, but many are supplied with power from the rig, often on the same wire carrying the audio.

XMIT Modulation

Different modulation modes sound different. We all know that, but why is it so?

In theory, modulation is modulation, and it shouldn't make any difference what kind you use, as long as the received signal levels are adequate to prevent noise on the demodulated output. But you've heard it said that FM sounds the best, AM is great, and SSB is the worst. Is this true? Well, yes. Also, no.

FM does sound great. Most FM rigs, including HTs, are supplied with condenser mikes, so they start with natural voice quality. FM modulators and demodulators can be made very linear, which means low distortion. Also, the inherent noise-canceling effect of FM makes it seem especially clean, and the punch of a tinny mike is not needed. (In fact, excessive high frequency response makes a noisy, weak FM signal even worse, since it dilutes the tiny signal energy across a wider bandwidth.)

Finally, the IF bandwidth in FM receivers is quite a bit wider than the transmitter's deviation bandwidth, and unlike AM and SSB, it is not directly related to high frequency response. As a result, the receiver's selectivity filtering does not degrade the audio. Altogether, there's not much to interfere with the quality of FM, at least under local conditions. (Multipath and fading distortions make FM a dicey proposition for HF, although it is still fun.) If you were allowed 15 kHz audio bandwidth and wider deviation, you could sound just like your local rock and roll station.

AM. Ask any AMer and he will tell you that AM sounds much better than SSB. Is this true? Yup, but it doesn't have to be. Recently, I had the opportunity to play with the new Kenwood TS-950S HF rig, which has the facility to allow receiver filter selection independent of mode. I tuned an SSB signal in, and it sounded normal. Then I *removed* the SSB filter, and wow, it sounded exactly like AM—much crisper and brighter and altogether more pleasant. At last I could confirm what I'd always suspected: The deficiency seemingly inherent in SSB is actually caused by the sideband filter. (More on this later.)

The AM mode is simple and easy to do. In order to avoid having to make all the transmitter stages linear, though, modulation is usually accomplished right at the finals, by means of feeding their DC power through a transformer and pumping audio into the other side. The power fluctuates, and so does the output power, and there you have it—AM.

Of course there is always some audio phase distortion with a transformer, but it is negligible by voice communications standards. And without a sideband filter, the high-frequency rolloff can be rather gradual, resulting in considerably more than 3 kHz audio bandwidth. It's illegal, but it sounds real nice. So, AM is pretty darned good. But then, the amount of received noise is usually greater than with FM, so it sounds a little less clean.

And then there's selective fading, when one sideband fades more than the other, causing horrendous distortion. AM is especially prone to this kind of problem, because it includes and demodulates both sidebands. You can avoid it by clipping off one sideband, but then you may as well just go to SSB, because the clipping filter will make it sound the same.

SSB—is it bad? No, not at all. It is far and away the most power-efficient mode, and the audio is adequate for our normal uses. But it does sound a bit odd, even when the signal is precisely tuned in. To me, it sounds constricted. Of course, the filtering does cut the high frequencies off rather steeply at 3 kHz, which is required by law anyway. (Are you listening, AMers?) But it's more than that.

It appears to come from the resonance of the sideband filter. Any such steep filter will ring a little bit, and in some rigs you can hear it by tuning in background noise with no signal. If you listen carefully, you can discern a definite pitch to the noise, and this pitch is the resonance of the filter. Switch to AM and the note will be gone.

Remember that the sideband filter is used both in transmit and receive, so its effects are doubled. Is there another way? Yes, there is, and it is actually older than the way we do it now. Early sideband rigs used a technique called "phasing" to generate and receive SSB. In this method, transmit and receive signals at the IF level were split 90 degrees out of phase and combined in a special sort of mixer to cancel one sideband. It worked fine, but it was tricky to align and required lots of components.

Also, the phase relationships had to remain constant over the required bandwidth, or insufficient alternate sideband suppression and/or distortion could result. The great part of the scheme was that there was no sideband filter. At the time, the prime considerations were cost and availability—the ordinary parts were cheaper and easier to get than a good steep filter. What no one even realized then was that the technique held the promise of sounding better than a filter. Unfortunately, phasing rigs have disappeared as good, inexpensive filters have dominated the scene.

Is it too late for phasing? Maybe not. With today's technology, good and stable phasing circuitry should be simple to accomplish. Then, the IF filtering could be better tailored to avoid that tight, almost-ringing sound associated with SSB.

SSB Filter Adjustment

If your LSB and USB don't sound the same, your rig may need adjustment. They should have approximately the same tonal balance. An easy way to check is to let the rig warm up for about 15 minutes and then tune to where there is only band noise and no signal. Switch between the two sidebands and note the sound. They are not likely to be exactly the same because the two skirts of the sideband filter are never perfectly symmetrical. If the two sound *very* different, one or both may need adjustment.

Check the service manual for the carrier oscillator adjustments. These determine the exact frequency of the signal sent through the filter, and there is one for each sideband. Turning them will vary the audio response from tinny to bassy.

Incorrect adjustment can result in poor adjacent sideband suppression on both transmit and receive, so it is important to set them carefully. The manual should detail the correct procedure.

Well, that's about it. See you all next month. 73

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

CoCo Packet

Here in Maryland, February is the month with the reputation of blessing us with the most snow of the winter. So, as I sit here looking at my beautiful doublet antenna that took me so long to get up, as it now lies frozen on the ground, let's have a look at what interests you.

Michael Simmons WB9CWE of Charleston, Illinois, relates being an avid reader of "RTTY Loop" who has a special interest in the Tandy Color Computer. He states that to his chagrin, he has noticed a painful lack of packet software for the CoCo. He is wondering if there is any source, commercial or public domain, for packet software for this computer.

Well, Michael, my search for packet software reaches back many years, and I will say up front that I have often been as frustrated as you are. Several years ago, noticing that some of the original work on digital modes was done on Motorola (6800 and offspring) microprocessors, I wrote to several of the pioneers, asking them if software applicable to the masses would be in the offing. To a man, they responded, "No."

It seems that, all things considered, most of the applications for general purpose (not dedicated) microcomputers were just not suited to packet or AMTOR as configured, usually because of hardware constraints. This is not to say that someone, somewhere, did not write a program to put the 6809 (the CoCo's CPU) onto packet; it's just that no one told me about it.

As it sits now, the best bet for packet is to use your computer as a powerful terminal, with one of the many terminal programs, and allow a dedicated microprocessor in a box, a packet terminal, to do the hard part. That way, you can have the best of both worlds.

Oh, yes, one other point Michael mentioned in his letter. He asked if it were possible to convince ham radio software writers to give some serious attention to writing communications software for the CoCo. Michael notes that this computer has evolved into a rather sophisticated machine with full features, making the lack of support by the various commercial software publishers very puzzling.

Puzzling? Not if you consider the size of the installed base of computers among radio amateurs. Again, I queried some of the software houses, and that is exactly what I heard. Yes, the CoCo is a fine machine, but the fact remains that there are more C-64s and PC clones in ham shacks than CoCo's. There are several public domain or shareware programs, but, as you know, essentially no commercial ones. A company just cannot afford the development and marketing costs of a program that may receive only limited support from the community.

Hope the information helps. Who knows, maybe one of our readers will roll up his sleeves and write that program!

Copying and Receiving CW

Norm Boles WJ5Z of Las Cruces, New Mexico, is particularly interested in copying CW on his computer. Again, Norm, I have looked and found nothing. There are several CW practice programs around, and in fact, such a program is relatively easy to write in BASIC. Yes, if there is a demand I will print one here, but only if more than one of you asks for it.

Receiving CW is another matter. I agree that the CoCo is well-suited to the task, but no one has written the program—yet! If I hear something, you can be sure I'll pass it along.

The Mighty Mite

From the newest to one of the oldest—machines, that is—I have another letter here from Bob Schaumleffel WA2IKS, of Olean, New York, who speaks to my recollection of the Mighty Mite printer. Bob seconds the comment that this machine, if you can find one, is a beast to align but a workhorse once it is.

He purchased one about six years ago, complete with manuals (now that's a find), went through the alignment procedures, and found that if an adjustment was off a few thousandths of an inch, the little feller wouldn't work properly. He finally got it to perk along, and it is still in use today as one of his hard copy machines.

Bob also feels that if you plan to get a Mite working, it's not a bad idea to pick up a junker at a hamfest. Parts are hard to come by and any source wouldn't hurt! Thanks for the letter, Bob. Notes from youngsters like you keep us all hopping. And thanks for the stamp on the letter. It's been quite a few years since I've seen the 5 cent amateur radio stamp. That I'm old enough to have some put away, and remember when 5 cents was first class postage, is frightening enough!

Solder Sniffer Award

The RTTY Loop 1991 Solder Sniffer award candidate this month is Rob Zahora of Burlington, Massachusetts. Rob writes that he has finished the TU-1000, published in the June 1985 issue of *73*. Now, as soon as he gets a Baudot to ASCII conversion board, he should be in business. Hey Rob, please let us all know how things work out.

PK-232 Quirk

A cautionary note arrived in the mail from Bill Weatherford WA0NDF/TU4CQ, Cote d'Ivoire. Bill is using the AEA PK-232 with his Leading Edge Model D computer, and a friend of his is also using a PK-232 with an Apple II+. Both of them are quite pleased with the PK-232, but noted an interesting quirk.

Like many "boxes" which come into the shack these days, the PK-232 does not come with a power supply. Bill points out that the manual for this terminal calls for 12 volts DC at 1 ampere on one page, and at 750 mA on another. He found that if you run it at a tad less than 750 mA, you get all sorts of weird results. To stay on the safe side, be sure to use a power supply that can supply the full ampere. A marginal supply just won't do here. Thanks for the tip, Bill.

Problem of the Month

This one comes from Leslie Bruce W0OX (ex-W9BSR/W7KMD/W0EHX/K5AXW) of Boulder, Colorado. Leslie states that after many years of Model 14s, 19s, 28s, 33s, and 35s, he is now all computerized, and he hopes to obtain hard copy from his computer printer while using the computer on RTTY.

With a C-64, Hamtext cartridge, a Flesher TU-170, and a Blue Chip printer, Leslie wonders if there is a way that he can print on the printer both the transmitted and received data while using the split screen display of Hamtext. I don't know, but if the manual does not say so, I will guess that you can't. There are enough others out there with similar setups, so if it's possible, hopefully I will hear about it soon enough. If so, I'll pass it along here in "RTTY Loop."

On another note, Leslie wonders what his Blue Chip printer looks like to other programs. With printer drivers like Epson, Gemini, Panasonic, Silver Reed, Okidata, etc., there is no mention of Blue Chip. Well, to the bast of my knowledge, the Blue Chip is one of a series of printers which emulates the Epson MX-80/FX-80 standards. I would call it an Epson, and hope for the best.

Good luck, and I hope to hear from you again. I'm glad the years have not blunted your initiative in this crazy hobby of ours.

Get in Touch

As always, I remain available to your thoughts or such via mail, at the above address, or on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). I love hearing from you, and you never know when your obscure question will end up here in print for everyone to see!

Next month, don't miss *73* as "RTTY Loop" Marches along. (Sorry... I couldn't help myself!)

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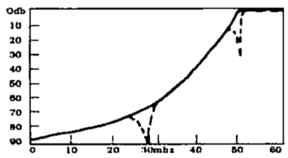

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LOOKING WEST

Bill Pasternak WA6ITF
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Meet Peyton Montcure

In the October issue we interviewed Tom McMillan WB3HGW, the man responsible for the FCC decision to relax CW testing standards in upgrades for the handicapped. In the December issue, we interviewed April Moell, a professional occupational therapist who uses amateur radio in the rehabilitation process. Now we come to the other end of the spectrum. To a man who feels that no handicapped person should be required to pass any form of Morse code test for a ham ticket anywhere in the world. So emphatic in this quest is law student Peyton Montcure that he has taken his demand to the United Nations, and he may soon take the United States to court.

What follows is the transcript of an interview that aired during last summer's second "No-Code National Teleconference Radio Net." Montcure was interviewed by *Newsline* correspondent Steve Bauer KCØHF. Ironically, being blind, Bauer himself is a handicapped person.

From the No-Code Teleconference

Bauer: Who is Peyton Montcure and how did he become interested in amateur radio?

Montcure: I became interested in ham radio years ago when a ham radio operator came to my house when I was still a child, and gave me a little introduction. I was very interested in it—but I couldn't use a telegraph key. I found that I simply couldn't coordinate my muscles so that I could get any sort of rhythm or speed. I gave it up and forgot about it and went on with my life.

Since then, I went through college and my learning disability was diagnosed. I found out, for example, that I cannot use a manual typewriter, but I can use an electric typewriter or a word processor. Again, it was the same problem with physical coordination.

I went to law school and began to get very interested in issues related to the handicapped. One day I thought that I would write to the FCC—because I had some time and I thought it would be fun to get into ham radio. I had recently attended a talk that a ham radio group held suggesting that people might like to get involved in it. Much to my surprise, and indeed shock—because I thought that so much progress had been made regarding issues for the handicapped—I found that the FCC would not even accept my complaint!

They did not even appear to know what a civil rights complaint was. They didn't want to waive the code for me or anyone. But I managed to work my way up the chain, finally writing a letter to President Bush, and getting the FCC to accept my civil rights complaint.

They have since rejected it, which they are entitled to do, giving as a reason that the Americans With Disabilities Act of 1989 has not yet been passed by Congress. But of course it will be. As soon as it is passed, I will file another civil rights complaint. Either the FCC will change its rules so that the code will be waived for the handicapped, or I will end up filing another complaint.

After all, the object is to integrate the handicapped into American society, and one of the best ways to do this is to get them fully into transportation, and in this case, communications.

Bauer: The commission has recently announced that a handicapped applicant—after passing a 5 word per minute code test—with proper medical certification will not be required to pass additional code tests. Does this change the FCC rules enough to basically satisfy your need and make you happy?

Montcure: No, this does not satisfy me or make me happy. The FCC apparently has a battle going on internally as to whether they are going to keep the code or not. The point at issue here is this: If I am in a wheelchair outside the FCC building and want to get inside, would they tell me that I have to get up out of my wheelchair and struggle up the steps at 5 or 20 steps per minute? Why can't I use the ramp? If I am handicapped and cannot use the code at all, why should I have to learn it? It just does not make sense.

Bauer: What about the theory part of the test? Should that also be waived for anybody that claims a disability in that area?

Montcure: I can't see what sort of disability would necessitate waiving any other part of the test. A civil rights official would really need to deal with that issue. If somebody could present information proving that they could not handle some particular part of the test, maybe some modification to some other part of the test would be appropriate. I frankly cannot imagine any problem there, because we are certainly not talking about any physical handicap.

Bauer: How would you respond to a handicapped person who had passed a code test, and who challenged you on your particular views regarding the handicapped and code testing?

Montcure: I would first congratulate them on being able to pass a code test or use a manual typewriter. But handicaps do vary from individual to individual. Some can do it, and some can't!

If you can do it, fine. But the object here is to arrange for the handicapped to communicate like everyone else, and not to restrict them by some arbitrary or capricious standard, such as using a key which is irrelevant to voice communications.

Bauer: Let's assume that you have passed the state bar and you are a practicing attorney. How would you feel if the firm you were working for hired someone who used their handicap to get out of taking 50% of the courses you had to pass in order to become an attorney?

Montcure: It would depend on the particular courses. Certainly I would want them to take the courses that are necessary to practice law, but if the Board of Bar Examiners also required the individual to run a marathon, and then swim, and canoe, and do certain other physical exercises, I would not see any sense in that. In other words, each separate test must have a reason behind it that justifies it, and that justifies excluding individuals who cannot pass it. The code test simply does not meet that test.

Bauer: But you may get on the air and never have to figure out an Ohms Law formula! I guess what I am trying to find an answer to is where do we stop cutting? Where do we stop diluting the requirements for not only amateur radio but for other things?

Montcure: In the language of the 1973 Rehabilitation Act that Congress passed, the question was whether the handicapped person is otherwise qualified. I cannot see how someone who did not know electrical theory could be qualified to operate a ham radio station. That is very important to the operation of amateur radio gear. And I can understand, for example, that the FCC might like to pass a law saying that people who cannot operate a code key, and who do qualify without learning the code, are absolutely forbidden from using a code key, by law!!

Bauer: When the FCC formalizes their new proposal concerning waiving upgrade CW tests for handicapped persons, will you try the 5 wpm test yourself?

Montcure: I expect that the Americans With Disabilities Act will be passed by Congress very shortly, and that requires accommodation in communications. As soon as that bill becomes law, I intend to file another civil rights complaint, and I imagine that the code standard will be done away with for those who cannot operate a telegraph key.

Naturally, it it were found that I or some other handicapped individual could manage the key in order to broadcast, that would be fine. But five words per minute is absurd!

Bauer: Have you done any studying for the theory part of the test?

Montcure: I certainly would not want to start studying for the thing until I know that I will be permitted some day to operate ham radio. I shall not start studying until at least the Americans in Disabilities Act passes, or until the FCC decides the complaint in my favor.

Bauer: What class of license would you go for?

Montcure: I would only be interested in a fairly basic license. I suppose in future years I might decide that I want to go for a higher class, but I am just a beginner and when you are a beginner you want to start at the beginning.

Bauer: Thank you for your time.

[An audiocassette of Steve Bauer's interview with Peyton Montcure, edited for air over repeaters and on nets, is available for $5.00 postpaid from The Amateur Radio Newsline, *Editorial Office, at my address at the top of this column. Prepaid only. No COD or credit cards.]*

> ***"I can understand . . . that the FCC might like to pass a law saying that people who . . . qualify without learning the code are absolutely forbidden from using a code key, by law!!"***

Epilogue

About a month after Steve Bauer interviewed Peyton Montcure, Congress passed the Americans With Disabilities Act. A week later, in a nationally televised ceremony, the bill was signed into law by President George Bush. This has opened the way for Peyton Montcure, and possibly others, to again challenge the need for handicapped applicants for amateur licenses to pass a Morse code test al any speed.

It's not the job of "Looking West" to pass judgment on the issue. Rather, that is for each one of us to do individually. What we have tried to do these past several months is to provide a good cross-section of the views. Now it is really up to the FCC, and possibly the federal courts. Only time will tell.

Next Time Around

"Looking West" will be back in April to discuss the rights of repeater users. Just how much power should users have over the way a repeater is run? One California coordination council says that the time has come to recognize the users of repeaters as the supreme beings, and in doing so, they may have relegated repeaters to ham radio public utilities, and their owners to becoming unpaid service providers! Join my guest co-writer, Rich Yarigian N6PVP, as we explore this issue . . . de WA6ITF

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JOIN GROUP 05/91 Ham expedition operating in Soviet Ukraine—help with your Soviet license, lodging, equipment, travel, etc. KK4WW and UB5WE. Audio tape by UB5WE all about Soviet hams. DXing, QSLing, equipment, history, regulation, and much more. Very informative. $9.97 to UB5WE Victor Gorokhousky, PO Box 1, Blacksburg VA 24063-0001. BNB945

WANTED: Pre-1980 microcomputers and publications for museum. KK4WW, Dave Larsen, Blacksburg Group. PO Box 1, Blacksburg VA 24063. (703) 763-3311. BNB956

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FIVE WATTS! 30/40 meter transmitter! Radio Shack parts! Plans—$2 plus stamp! Bill Lauterbach, 1709 North West Ave., #103, Jackson MI 49202. BNB962

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WANTED: Panasonic AG-100 camcorder junker for parts. Marvin Moss W4UXJ, Box 28601, Atlanta GA 30358. BNB982

NEED QSL CARDS? Ours are different! N4ZDU, Gilmores Printing, Rt. #3, Box 1151, Oldtown FL 32680. BNB983

Never Say Die

Continued from page 4

free passes for the vendor area. And then they were even angrier when some of their booth salesmen sneaked into the paid area, got caught red-handed buying equipment, and were thrown out when they still refused to buy tickets. How outrageous of Ham Com to stand up to these bullies! I don't recall that ever happening before.

Hey, That Was A Great QSO!

When's the last time someone told you that? How about it? Have you settled Into a rigid, boring format with your contacts? How'd you like to have the hams you talk with disappointed when the contact is over and eager to talk with you again?

The fact is that you can become an absolute charmer over the air. It's easy. You're just going to have to break a lifelong bad habit. And the best part is that the better you are to talk with, the more fun you're going to have. It's a win-win situation.

Obviously you're going to have to make some changes. Well, you know for sure that the way you've been going about making contacts hasn't worked well. Oh, sure, you've been swapping signal reports and stuff. But how many really fascinating contacts have you had recently?

Am I about to divulge some great secret? Some key to the hidden, almost completely untapped wealth we have available to us in amateur radio? Yep! That's about the size of it.

Let's go about this logically first, then we can go into the nuts and bolts. We'll start with the most basic question: Who is the most fascinating person in the world to the ham you're contacting? Clue: It isn't you. Revelation: It's him!

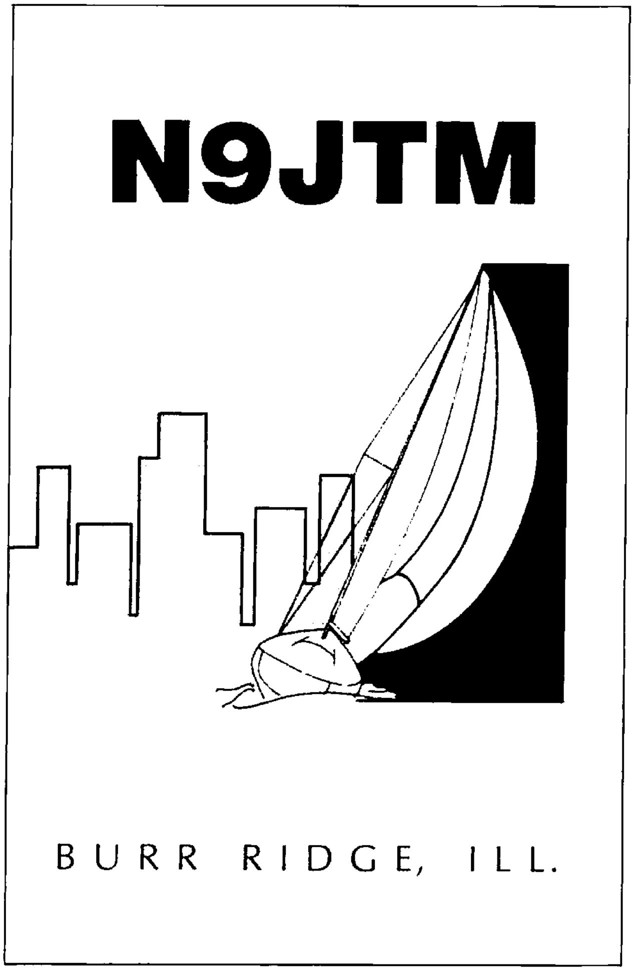
Now, a note to women's libbers, who have been working industriously to louse up the language: What few women hams we have do not need any help with spiffing up their contacts. Merely being women will make them interesting to men. My comments here are meant for men, who are the ones with the problem. You know, I haven't heard a YL on the air in months! Where are they? (I'll tell you later.)

Sorry for the diversion, but I knew that as soon as I mentioned "he" for a ham, I'd have a flurry of furious letters from militant YLs. I wish they'd spend more time on the air and less angrily fighting for their "rights." If we had more YLs on our bands I wouldn't need to write about how to have more interesting contacts.

Okay, I've established the obvious: The most interesting person in the entire world to the chap you've contacted Is him. Thus it follows that the more you can get him to talk about himself, the more he's going to enjoy the contact.

In case you're not following my message, your usual recitation doesn't cut the mustard. He really doesn't give a damn what rig you're using. He won't be amused by your weather, town, antenna and so on. Whoo, that sure cuts down on your transmissions, doesn't it?

If you aren't going to babble the usual dreadfully boring drivel, what can you talk about? How about mentioning what kind of work you do and then ask him what he does . . . or perhaps what he did before he retired? There are many questions you can ask that will open the floodgates.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

How did he get involved in amateur radio? Are his kids hams? Why not? Has be ever gone to the Dayton Hamvention? What other aspects of the hobby has he tried? Start making a list of questions which you've found to get the conversation going and keep it by your log.

Step two is to keep your log in much more detail. Make notes on what your contact is telling you so the next time you contact him you'll be able to recall the conversation and carry it on from where you left off. Your best bet here is to use a computer. Second best is to use paper, with a dedicated separate sheet for every contact. Don't try to cram it on a 3" x 5" card. Not even a 4" x 6" card. Go wild and use a whole sheet. Put the call in the upper left hand corner and keep your contacts by call in a file folder close at hand.

You'll get me talking if you ask about some of the countries I've operated from. Or about some of the exciting times I've had on the air. Or the interesting hams I've known. Or my first hamfest (1938). I've had some great adventures in my hamming . . . even some close calls with death. How about you?

Men Don't Talk Much

There is a basic difference between how men and women communicate. It starts when they first learn to talk. Boys play with each other. Girls ditto. The differences in their communications are basic and biologic. Boys are basically adversarial and girls aren't. Alas, most men never learn to actually talk with their wives . . . and vice versa.

With men it's our egos on the line with every contact. With women it's their hearts on the line. We want to see who's best and they want to be loved, putting it bluntly. Having been brought up from year one like this, it takes some serious habit breaking to change. Is it any wonder we have so few YLs on our bands?

Maybe you've noticed that men tend to make a contest out of anything and everything. How many countries we've worked is a measure of our masculinity. How many counties, certificates, how we do in operating contests, how big our rig, our antenna, how elaborate our mobile rig, etc.

They don't call the Cadillac the answer to America's inferiority complex by accident. We're trying to cope with feelings of inferiority with bravado and big signals.

DXers are well aware that DXCC is a serious threat to our hobby and could wipe it out at WARC. But egos are on line here, backed by millions of dollars in monster antennas and multi-kilowatt amplifiers. These DXers have no interest whatever in talking with anyone. They want a card. They need a card as badly as a crack addict needs a fix. And they'll spend whatever it takes to get the card.

There are a few ops in rare countries who have been making a happy living off these egos. They sort out the "green stamps" in their daily mail. I am old enough so I can remember when hams used to send a dollar to assure a QSL. Now anyone really wanting a DX QSL wouldn't consider less than a $20 bill. Some tell me they send $100, "just to be sure."

I've told you about the DXpeditioner who bragged about clearing over $50,000 a year tax-free in such "donations." And that was 30 years ago, so that's more like $500,000 in today's dollarettes. It's almost enough to get me to retire and do some traveling.

I'm Listening

Yep, I'm going to be listening to see if you are able to change your ways. Will you start asking questions and listening, or are you going to keep right on just "broadcasting" the same old tripe? Unless you can get started actually communicating instead of egoing yourself all over the world, the bands are going to keep right on being a dreadful bore.

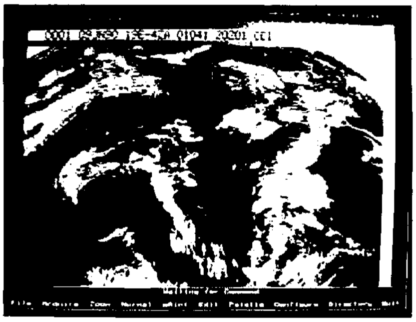
Now I'll see how many readers write that they don't always agree with me. If you disagree, let me know why. And I want a well considered response, not an angry, ego-driven one. Who knows, we might eventually even be able to talk with YLs over the air!

Did you see *When Harry Met Sally*? Well, rent it. Billy Crystal explains why men and women can never be friends. It's humorous, but it's true, too. Can we men, after being trained from birth to be the way we are, ever change?

No Code—At Last!

Okay, it's here . . . finally! The FCC took the easy (and clever) way out. They merely eliminated the code requirement for the Tech license. If 2m doesn't turn into a CB-type mess in days, thousands of old-timers are going to be terribly red-faced, since that's what they've been saying would inevitably happen.

What change will this make? Firstly, it will remove the last feeble excuse kids have for not getting a ham ticket. And I'm talking major feeble here, considering that people who use the *73*



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code system can usually master 5 wpm in a couple hours.

Is this marvelous rule change going to bring us the 50,000 new hams a year the ARRL promised they'd provide? I laugh. My view: If we stood on a corner in New York and tried to give away ham tickets we couldn't do it. The general public no longer has the vaguest recollection ot what amateur radio is. We've so totally avoided promoting our hobby for the last 25 years we're now almost invisible.

With no 5 wpm code test for Techs I believe we'll find that those we are able to interest in going on to General will be able to learn 13 per much easier. Those few hams who have started right out at 13 wpm and avoided slower speeds have been able to master the code in a few hours instead of living through months of grinding frustration.

A number of readers have suggested that I start a new national organization and do the amateur radio promotion which needs to be done. No, I don't need the aggravation that fighting the League would bring. No, you're going to have to either clean up the ARRL or else take up a new hobby when we lose this one through neglect.

We need to do something to revive an interest in CW. Our bands are split into CW and voice subbands, but it doesn't take much listening before you discover that the voice bands are busy and the CW bands oddly vacant. I've gotten several letters recently from hams who've taken the time to count signals on a regular basis. This might be a good club activity. Assign different bands to your members and get them to make an hourly activity count of CW, RTTY, Packet, SSB, SSTV and AM signals on each HF band.

If you'll run the counts and send 'em in, I'll get 'em correlated so we'll have something approaching a scientific study. We need to know how much activity we have on what bands. . . when. In counting, never mind how many stations are in nets. We just want to know how many frequencies are being used for contacts. . . so a net or even a DX pile-up would count as one contact.

In sending In reports, please mention if you're part of a club activity (and the club). I'd like to publish a list of the clubs which have shown enough interest in the hobby to help with projects like this.

As far as I know nothing like this has been done by amateurs before. Some commercial studies of amateur band use have been done in preparation for pressuring the FCC to give them parts of our bands. They used wideband spectrum analyzers and video tape. . . which not many of us have access to.

The Pudding

Will this new no-code Tech license open the floodgates and get us into a growth mode again? I hate to be Ol' Doc Gloom, but I'll be surprised if this alone makes much difference. We'll know more a year from now when we can compare the change in new licenses being issued.

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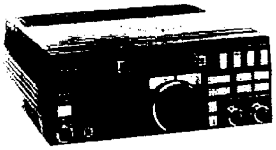

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Notes from FN42

Several weeks ago after parking my car at work, I was pleasantly surprised when a car stopped, and a young man stepped out and asked me if I was a ham. He had seen my callsign on my license plates and wondered if I knew of any local clubs offering ham classes. I had to admit that I didn't, but that I'd check, and that he should call me at my office.

I haven't found a club yet with classes going on, but I've been thinking about trying to do something myself. In the non-ham world, I teach at a small liberal arts college in New Hampshire. What about a one-semester ham course, meeting about one evening a week? That'd be at least 14 meetings. My understanding from other faculty is that there used to be a ham station on campus for faculty and students. It appears that the ham shack and equipment have passed into oblivion. But ham radio has not! Anybody in the Rindge, New Hampshire, area want to help me?

This brings up a subject I discussed with David N1GPH, my fearless leader (after Wayne, of course). Wouldn't it make sense for 73 Amateur Radio Today *to sponsor ham classes at the elementary and high schools in the New Hampshire area? David said that it would, but only if people wouldn't think that 73 was doing it just to sell subscriptions and Wayne's code tapes and study material.*

I had to admit that I hadn't thought of it that way, but he was probably right. Then I asked my favorite question, WHY? WHY can't ham radio magazines and their employees sponsor ham classes? WHY can't we use some of the magazine's resources to increase the numbers in our wonderful hobby? Don't many of our clubs strongly suggest to our struggling Novices-to-be that they purchase one set of code tapes or the other, and one particular study guide or the other? WHY is that any different from 73 or QST or CQ suggesting that the student use certain study materials?

Since this column is supposed to zero in on international happenings, I will pose the same question to ALL hams. WHY can't ham magazines use their integral talents and resources to increase the ham population of the world? You tell us whether ham magazines should or shouldn't be able to sponsor ham classes.—Arnie N1BAC.

USSR

Early in 1989 a new radio club, "Advanced Communications DX Association (ACDXA)," was formed in the USSR to promote the usual good things that radio clubs try to do, such as foster international friendship and good will, and sponsor contests and expeditions. The founders are Valery RA9YD and Yuri UA9YE. Both are officers of the association.

ACDXA Awards Program. The ACDXA awards will be issued to any licensed amateur or listener over the world.

Each contact must be confirmed in the form of a QSL card received by the applicant.

Each application must be accompanied by a list showing the dates of the contacts, and include a statement by two licensed amateurs that the necessary cards have been checked.

Contacts must all be made from the same country, on any band or mode, beginning January 1, 1985, if a specified requirement is not indicated in the rules.

After receiving the basic award, only the necessary additional confirmations are required for a higher class or endorsement.

The certificates are available for a fee of 7 IRCs or 3 IRCs per endorsement.

The cost of a plaque or trophy is 50 IRCs. In all cases the fee includes surface mail return postage. SCA and ACDXA Supertrophies are free.

Applications must be sent to the awards manager, ACDXA, PO Box 1, Barnaul 656057, USSR.

ACDXA. The applicant has to prove QSOs with 5 ACDXA members.

The ACDXA plaque is available for any applicants who have [been able] to prove contacts with each current ACDXA member.

Only contacts made on or after January 1, 1990 are acceptable.

All Soviet Nationalities Award (ASNA). In the spirit of developing friendly relations among nations and nationalities, the award will be issued to encourage communications with different national areas within the Union of Soviet Socialist Republics.

See the table for the basic award and trophy rules.

Territories for ASNA: Soviet Socialist Republics: UA, UB, UC, UD, UF, UG, UH, UI, UJ, UL, UM, UO, UP, UO, UR.

Autonomous SSRs: UA1N, UA4P, UA4S, UA4U, UA4W, UA4Y, UA6I, UA6J, UA6P, UA6W, UA6X, UA9W, UA9X, UAØO, UAØQ, UAØY, UD..N, UF..Q, UF..V, UI..Z.

National districts: UA1P, UA8T, UA8V, UA9G, UA9J, UA9K, UAØB, UAØH, UAØK, UAØX.

Autonomous oblasts: ..UA6E, UA6Y, UA6Z, UAØD, UAØW, UD..K, UF..O, UJ..R.

Soviet Cities Award (SCA). The applicant has to prove contacts with 100 cities of the Soviet Union.

Special endorsements are available for each additional 100 cities.

SCA-trophy is available for the achievement of 500 cities.

SCA-Supertrophy is available for achievement of all cities worked on the date of the application signed. All QSLs and appropriate return postage are to be sent to the awards manager.

The list of the Soviet Union's cities is available from the awards manager. Please SASE or SAE and 5 IRCs.

Good Neighbor Award (GONA). The applicant has to prove contacts with all countries which border the USSR.

Special endorsements for any band or mode are available.

The GONA-plaque will be issued to an applicant who has [been able] to prove contacts with all countries as those for GONA-certificate on each of five HF bands.

One necessary contact on each band may be substituted for a contact with another country adjacent to the necessary country, if the contact has been made on RTTY, AMTOR, or packet.

The list of countries: AP, BY, EP, HA, JA, JT, LA, OH, OK, PS, SP, TA, VU2, W, YA, YO.

"Ninety-Degree Line." The applicant has to prove contacts with those foreign countries and Soviet oblasts which lie on the 90 degree meridian. A5, BY, HC8, JT, S2, TG, UAØA, UAØB, UAØH, UAØW, UAØY, VE, VU, W, XE, YS.

U-RTTY-Award. In an effort to encourage digital communications on radio amateur bands, the U-RTTY-Award will be issued to any amateur or listener who can prove contacts with all ITU-zones within USSR (19–26, 29–35).

ACDXA-Supertrophy. The ACDXA-Supertrophy may be claimed by any holder of the following: ACDXA-plaque, SCA-trophy, GONA-plaque, ASNA-trophy, and U-RTTY-Award.

	USSR	DX
Basic award	51 QSOs*	25 QSOs**
Trophy	51 QSOs – 5 Bands***	51 QSOs – 3 Bands****

* – 15 Soviet Socialist Republics
20 autonomous SSRs
10 national districts
8 autonomous oblasts
any band, any mode

** – 10 Soviet Socialist Republics
15 autonomous SSRs
any band, any mode

*** – 51 QSOs on each of 5 HF bands, any mode
**** – 51 QSOs on each of either three HF bands, any mode

[In the following, please note 9M6HF's comments on pile-ups and the purpose of amateur radio. You can enjoy contesting and still be considerate—and maybe even take a few moments to talk about your interests and activities!]

MALAYSIA

Harris Abdullah 9M6HF
P.O. Box 13329
88837 Kota Kinabalu
Sabah Malaysia

Local activities. MARTS has, for the third year running, provided communication facilities during the Rally of Malaysia from September 1–4. This event, organized by the Malaysian Motor Sports Club (MMSC), gives MARTS members the opportunity to improve their traffic handling abilities. MMSC also organizes the World Superbike Championship on November 1–4 in Shah Alam, with MARTS participating.

The SEANET Convention was a success, attracting amateurs from 18 countries. As I was not able to attend the convention, I am not able to write a detailed report. This event, sponsored by the state government, was very well-organized, thanks to Festus Havelock 9M8FH. Due to his effort, interest in amateur radio in Sarawak has been revived. More stations with the 9M8 prefix should be on the air soon.

In 9M6, licensed amateurs and SWLs did their part in community service by providing the total communication facilities for the Climbathon, an annual mountain race up and down Mount Kinabalu (4,100 meters), organized by the Sabah Tourism Promotion Corporation. Held September 1–2, this is the second year in which the Sabah Amateur Radio Society has provided the service. Control stations were set up at intervals along the route to the peak. The guys who had volunteered to be stationed at the peak had to trek up the mountain from the base. As the event was held over two days, these poor guys had to do that twice, except that the second day's trek was from the resthouse located at the 3,000-meter level.

DX Activities. In 9M2, a number of amateurs are active on the air. Among them are: 9M2ZA, Zainal; 9M2AX, Ross; 9M2DX, Faizal; 9M2DW, Tan; 9M2GW, George; and 9M2KN, Ken. These are the stations I know of who are on the air frequently, and who can be heard mostly in the evenings (0700 UTC onwards). Other stations are also active on the HF bands at other times.

From 9M8, regulars on the air are: 9M8GH, Festus and 9M8PV, Andy. 9M8FH sometimes checks in with the W7PHO Net on 14.226.5 MHz. 9M8ZR (WA2HZR, Dave) was active in November, operating the last week of that month from Western Malaysia with the call 9M8ZR/2.

Active stations from 9M6-land are 9M6MO, Mohammad; 9M6JR, Janin; 9M6ET, Steve; 9M6IO, Senny (YL); 9M6HS, Hussein; 9M6MA, Hassan; 9M6MU, Alfons; and myself. All these stations are active on most weekends. 9M6MO has regular weekend skeds on 21.160 at 0800 UTC with his QSL manager. 9M6ET meets his QSL manager on 21.220 at 2300 UTC, and 9M6HF has a regular sked on 21.350 at the same time during the weekends. Of course, contact depends on the propagation conditions.

Stations soon to be on the air are 9M6MX, Mann and 9M6AF, Ken.

I am able to work all modes and bands except satellites and 160m. The only satellite station belonged to 9M6KT, Mike, who went QRT when he returned to the states last November. Most of the stations mentioned above have modest setups and only dipoles. 9M6MO, 9M6MA, 9M6MU, and 9M6HF are the only stations with tribander yagis.

9M6NA, Sate (JE1JKL) and 9M6OO, Bob (N2OO) were active from the middle to the end of November 1990. 9M6QQ, Hans, was also on the air during the same period, operating from two islands, Labuan and Banggi, for the IOTA award.

Local Growth. The amateur radio community is growing, albeit at a very slow pace. MARTS reported recently that there are 309 licensed amateurs in Malaysia, which includes Sabah and Sarawak. SWLs, of course, outnumber these by a factor of at least 2 to 1. It's quite amazing at how easily a 9M prefix attracts a pile-up, especially when the bands are open. Working through a pile-up is a tiring job, and most of us here prefer a nice chat and getting to know the operator at the other end, instead of trying to break their QSO record. Isn't the main aim of amateur radio to strengthen international goodwill and friendship? So, how do you achieve this by exchanging callsigns and signal reports? If you have an answer, I would be glad to hear it.

ATV

Number 27 on your Feedback card

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
Forest Road
Hancock NH 03449

The "Lookie-Talkie"

With the current trend towards miniature video components, it was inevitable that someone would come up with the video equivalent of an HT. Earl Campbell KS8J of Glendale, Arizona, has put together what he calls the "Lookie-Talkie." (See Photo A.) Take a small pocket portable TV set, a 1 watt ATV transmitter, a miniature B/W TV camera, preamp, gel cell and a 440 MHz rubber duck antenna, then mount it all in a plastic project box and you have an extremely portable ATV station. Now when Earl wants to go portable or mobile ATV he just grabs the "Lookie-Talkie" and heads for the door. . . no messy cables and adaptors to worry about!

Photo A. The "Lookie-Talkie."

Build your own "Lookie"

Use a Radio Shack Pocketvision 22 (the 23 and 24 models will work as well, but are somewhat larger) for the ATV receiver. This series of pocket LCD TVs tune directly through the 70cm ATV band and even tune below 421.25 MHz. With the addition of a Hamtronics preamp kit (LNW-400), you will have a very sensitive receive station.

Remove the back of the TV set to conserve room and mount it through a hole in the lid of a plastic project box

Photo B. The "Lookie" compared with a Yaesu 2 meter HT.

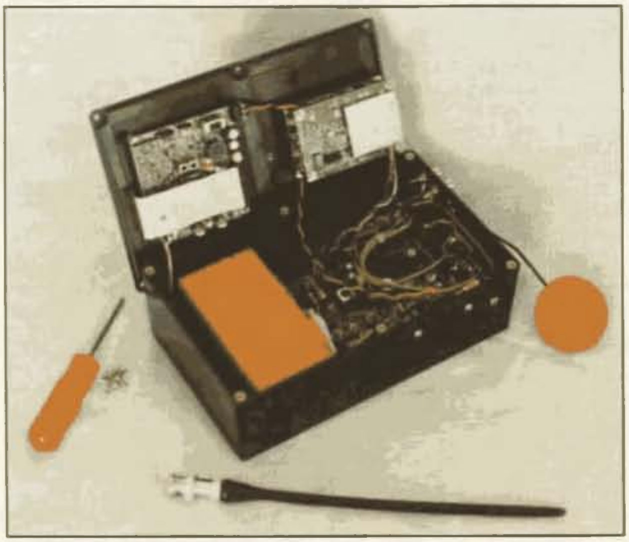
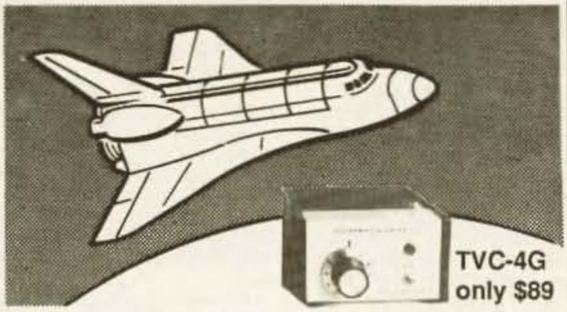


Photo C. Internal view of the "Lookie". Note that the TV camera and the back of TV receiver have their cases removed. Main part of the case contains the Kreepie-Peepie transmitter and the battery.

Photo D. KS8J ATV repeater site on top of Shaw Butte overlooking greater Phoenix. Roger KD7HH and Wayne N7MAO can be seen installing the new antennas.

Continued on page 78

AMATEUR TELEVISION



SEE THE SPACE SHUTTLE VIDEO

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to Satcom F2-R transponder 13. If it is being done in your area on 70 CM, all you need is one of our TVC-4G ATV 420-450 MHz downconveters, add any TV set to ch 3 and 70 CM antenna. Others may be retransmitting weather radar during significant storms. Once you get bitten by the ATV bug - and you will after seeing your first picture - show your shack with the TX70-1A companion ATV transmitter for only $279. It enables you to send back video from your camcorder, VCR or TV camera. ATV repeaters are springing up all over - check page 411 in the 90-91 ARRL Repeater Directory. Call for a copy of our complete 70, 33 & 23 CM ATV catalog.

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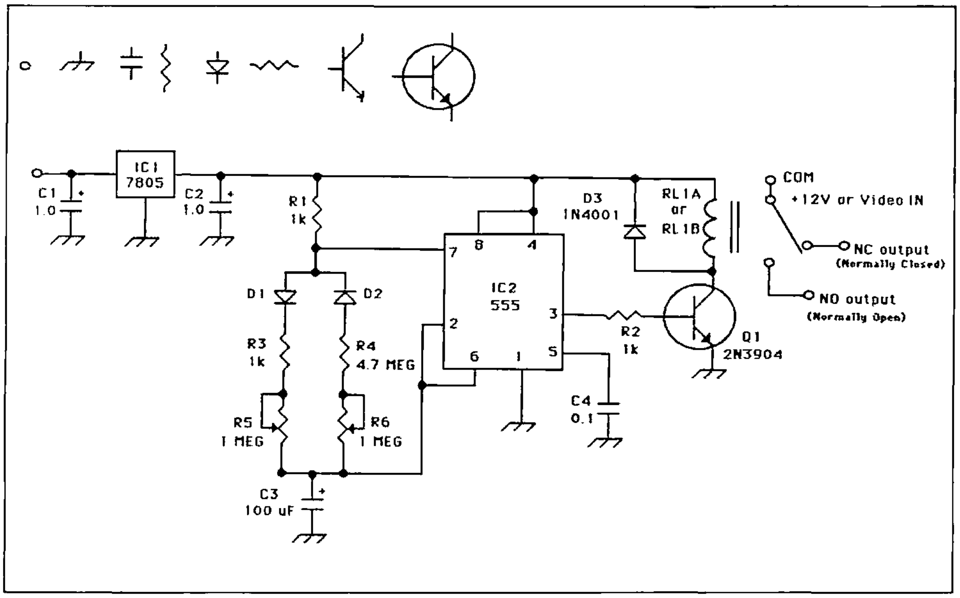

Figure 1. Ten minute timer schematic.

(RS# 270-224 or 270-232). (See Photo C.) Connect a Hamtronics preamp between the TV set's antenna jack and the DPDT antenna switch on the top of the box next to the BNC antenna jack. Just above the TV receiver, mount the small B/W TV camera with its case removed. This particular model was the Mitchell Industries Micro-Video camera. (The GBC CCD-100 is a similar sized camera and could be used as well.) Mount a P.C. Electronics KPA-5 transmitter to the back of the project box just above the 1.2 Ah gel cell battery.

The DPDT switch on the top of the box is used to switch the antenna jack from transmit to receive, as well as to supply power to turn the ATV transmitter on and off. Optional switches can be mounted for external audio or video inputs as well. Button it up and you should be ready for some real portable ATV action.

Walking around Phoenix with the "Lookie," Earl can watch the local ATV repeater with a P3 or better picture from over 20 miles away. He has taken it up on several flights on board a research jet for some really wild DX. His most recent flight took him from Arizona to Italy on a Cessna Citation jet at 42,000 feet. During this flight he used the "Lookie Talkie" to make aeronautical ATV contacts in Arizona, Minnesota and Great Britain!

Now that the video HT is a reality, who'll be the first with a Dick Tracy style ATV wristwatch?

Phoenix ATV

The AAA5 of Phoenix (Arizona Amateurs on A5) have quite an active group. Their local ATV repeater (KS8J/r) is about 2100 feet above the city on top of Shaw Butte. (See Photo D.) Shaw Butte is centrally located and provides coverage over a wide area of greater Phoenix. P5 quality reception has been consistently seen over 40 miles away. The repeater is vertically polarized with an input on 434 MHz (923.25 MHz alternate receive). Output is on 421.25 MHz. Most stations in the area need only 1 watt to access the repeater, so amplifiers are used only for distant simplex contacts or for mobile use. If you are in the Phoenix area, look for their weekly ATV net every Wednesday night at 7:30 p.m. The 2 meter talk frequency is via the 145.17 repeater (−600) or 145.17 MHz simplex. They can also be found on the 147.28 (+600) repeater during net nights as well. No need to wait for the net, however, since there is tons of activity most any night!

Ten Minute ID Timer

This little circuit (Figure 1) solves the problem of identifying your ATV system every 10 minutes. You can use it to automatically switch in another source of video via the onboard relay (computer or identifier), or use it to switch 12 volt power to another relay or device. There are spaces for two different kinds of relays on the board (only one relay is necessary). I prefer the Aromat relay since it draws less current. This circuit will drive both relays, however, if you'd like to control more than one device (see Figures 2 & 3). The 555 (use the standard 555, not the CMOS version) timer charge and discharge paths are independently controllable via the 1 MEG control pots. I usually set it up to ID for 5 seconds every 10 minutes. I've used this same circuit in my live camera balloon flights to kick in the video ID board for 30 seconds every two or three minutes (using a 22 or 33 µF capacitor for C3). It's been a reliable performer and fits in a small space. You should use a high quality tantalum or low leakage electrolytic for the timing capacitor. To set up the on/off ratio initially, use a capacitor that is 10 times less than your final value. That way you can make your adjustments without having to wait a full 10 minutes! Then just replace the small capacitor with the final value. If you can't achieve the desired delay interval with the adjustment pot R6, try varying the values of C3 and R4.

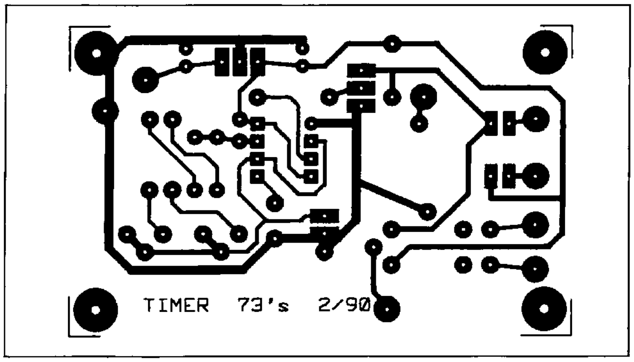

Figure 2. Timer PC foil pattern.

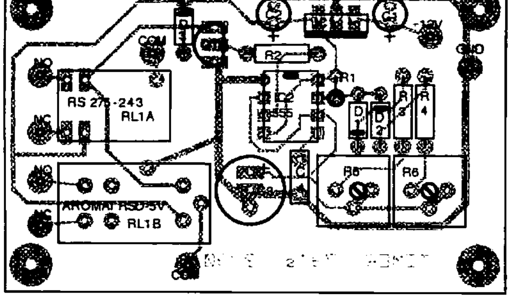

Figure 3. Timer parts placement.

Parts List (Ten Minute Timer)

R1,R2,R4	1k ohm ¼ watt resistor
R3	4.7 MEG ¼ watt resistor
R5,R6	1 MEG potentiometer
C1,C2	1.0 µF/35V tantalum capacitor
C3	100 microF/16V tantalum or electroytic capacitor
C4	0.1 microF disc ceramic capacitor
IC1	7805 5V regulator
IC2	555 timer IC
Q1	2N3904 NPN transistor
D1,D2	1N914 diode
D3	1N4001 diode
RL-1A	5 volt relay, RS#275-243
RL-2A	5 volt relay, Aromat RSD-5V (note 2)
Misc	8-pin IC socket, PC board (note 1)

Note 1: A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4 + $1.50 shipping/handling per order.
Note 2: The Aromat RSD-5V relay is available for $2 + $1.50 shipping from ARE Surplus, 15272 S.R. 12 East, Findlay OH 45840. Phone: (419) 422-1558.

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

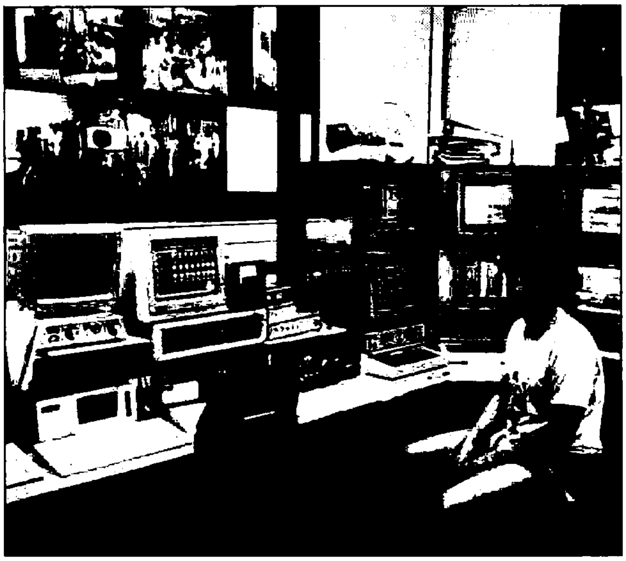

Photo B. Mark Allery G7DSY at the UoSAT control station at the University of Surrey. (N5FVM photo)

The Satellite Programs

Most universities do not build their own spacecraft. Until 1979 the University of Surrey in England was no exception. British university involvement prior to 1979 concentrated on the development of sensor systems, instrumentation, and detectors for experiments on board satellites built by industry.

Dr. Martin Sweeting G3YJO recognized an opportunity to expand the involvement of the University of Surrey to build small, low-cost spacecraft. Offered a launch opportunity by the United States, he and a small group of researchers in Surrey built not only satellite subsystems, but a whole satellite with its own power systems, experiments, control circuits and transmitters.

The goal was to create a satellite that could be monitored using simple systems on ham radio frequencies. The experiments were to be complex enough to stretch the abilities of university students, but still keep the emphasis on making the system output useful for educators at all grade levels, as well as for amateur radio operators. Experiments included a magnetometer, radiation counters, a charge-coupled device (CCD) camera, and an array of shortwave propagation beacons.

As Martin pointed out, today's school children are tomorrow's university students, and eventually our future spacecraft engineers.

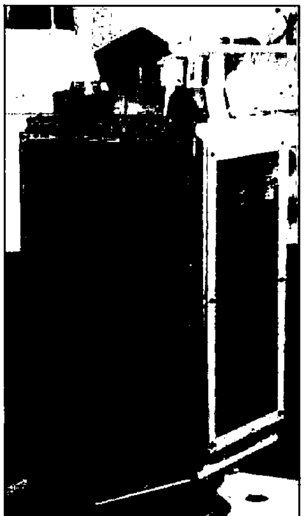

Photo A. This "fit-check" model of U-O-11 (launched 7 years ago) sits quietly in a lab at Surrey. (N5FVM photo)

UoSAT-1

UoSAT-1, also known as UoSAT-OSCAR-9, was launched by NASA on October 4, 1981, from the Vandenberg Air Force Base in California with the Solar Mesopheric Explorer. The launch vehicle was a Delta rocket. For the first days of its life, U-O-9 sent only an unmodulated carrier. Finally on October 9, 1981, the staff at Surrey managed to command U-O-9 to the 300 baud ASCII downlink mode. Until its fiery end in the atmosphere on October 13, 1989, U-O-9 sent telemetry either digitally via RTTY, CW or ASCII, or through the digital speech synthesizer system detailing the status of onboard sensors and experiments. The mission proved the viability of a university-inspired satellite program and generated interest from academic, technological, industrial and commercial sectors.

The success of the UoSAT-1 program encouraged G3YJO and others to continue with small satellites and to develop UoSAT-B, which would become UoSAT-2 or UoSAT-OSCAR-11 after launch. The U-O-11 mission was to fly a proof-of-concept digital store-and-forward communications experiment prior to a dedicated packet satellite spacecraft, and to use a launch opportunity made available by NASA.

The LANDSAT-4 Earth resources satellite needed to be replaced. The University of Surrey was officially informed of an opportunity in September 1983 for a ride to space in March 1984.

UoSAT-2

With only six months available, the team in England designed, fabricated, assembled, integrated and tested UoSAT-2, and were ready for another California launch from Vandenberg Air Force Base on March 1, 1984. Harold Price NK6K spent much of that time in Surrey living in Spartan conditions working with the Surrey team. The ride to orbit with LANDSAT-5 was uneventful, but only a day later the satellite would not respond to commands sent from the control station. After 10 weeks of intensive effort in England and at the Stanford Research Institute in California, U-O-11 was once again responding to commands and transmitting telemetry on 2 meters.

A logic gate had failed only hours after deployment, but the problem was not easily diagnosed from the ground.

U-O-11 is still in orbit and functioning. It is usually configured for 1200 baud telemetry on 145.825 MHz FM. The 350 mW 2 meter beacon can be heard successfully on most portable and mobile rigs. An old Bell 202-type modem with a simple modification to invert bit sense ("1" to "0" and "0" to "1") can provide the listener with plenty of telemetry to decode. Like U O-9, U-O-11 has a speech synthesizer, a CCD camera, and several modes for the telemetry downlink. U-O-11 also has a particle-wave experiment, a space-dust detector, and the Digital Communications Experiment (DCE).

UoSAT-3 and -4

On January 22, 1990, the University of Surrey added two more satellites to its continuing list of accomplishments.

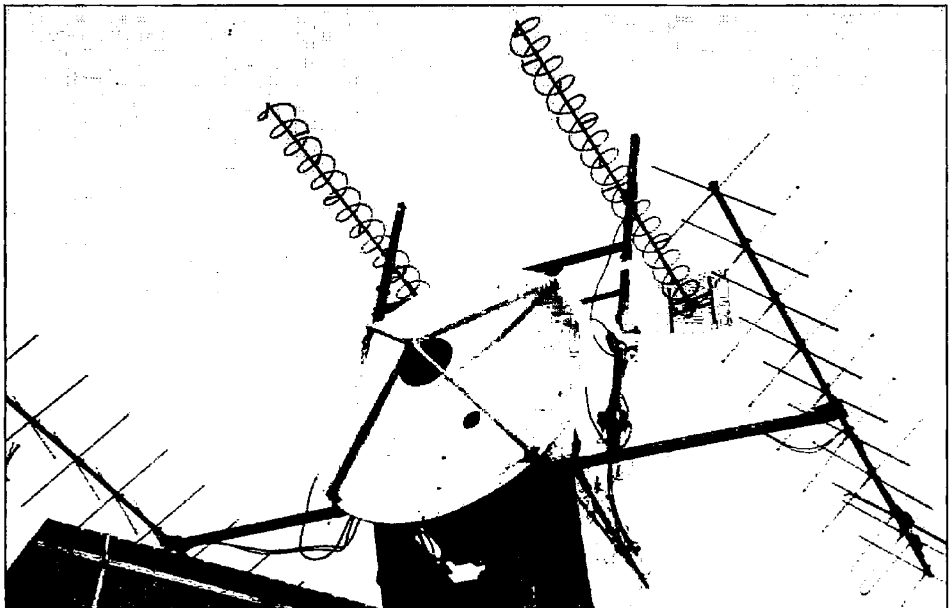

Photo C. Main University of Surrey satellite tracking antennas on a modified antiaircraft gun mount. (N5FVM photo)

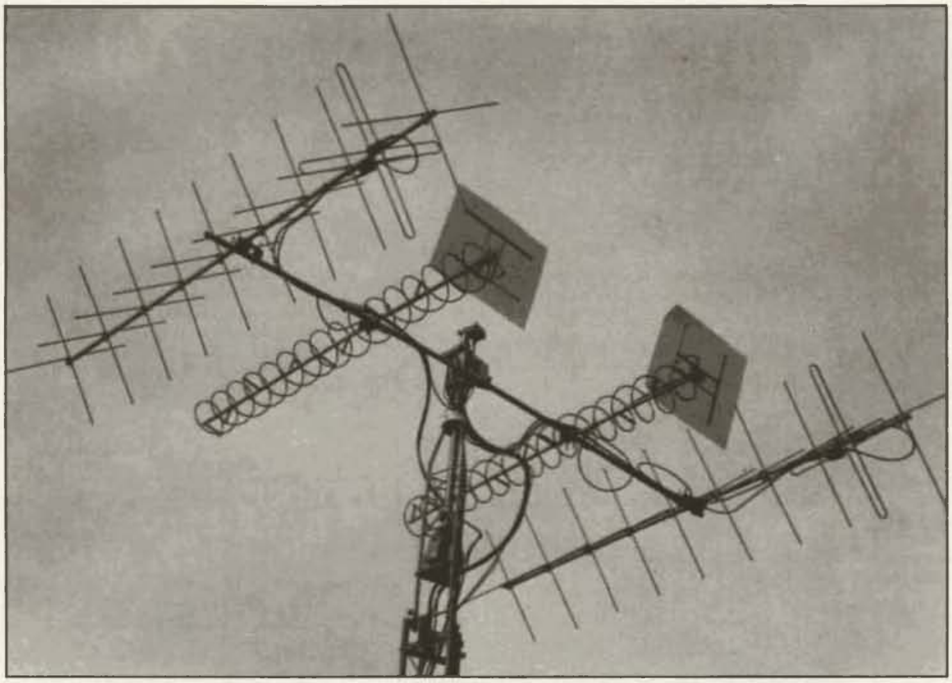

Photo D. Additional UoSAT antennas with crossed yagis on 2 meters and opposing helix antennas for 70cm. (N5FVM photo)

UoSAT-3, also known as UoSAT-OSCAR-14, and UoSAT-4 (UoSAT-OSCAR-15) were launched with the microsats by an Ariane-4 launcher as secondary payloads with the French SPOT-2 imaging satellite. UoSAT-OSCAR-14 is performing well with 9600 baud Mode "J" (2 meters up and 70cm down). The satellite also has cosmic particle and total radiation dose detection devices along with the packet radio communications experiment. Signals are loud and have been copied on incredibly simple systems. On several occasions, Jeff Ward GØ/K8KA has successfully connected to the satellite BBS and transferred several large files using portable radios and small antennas. For the 2 meter uplink he used a turnstile, while a small helix provided the downlink on 70cm.

Unfortunately, little has been heard from UoSAT-OSCAR-15 since the day after launch. Experiments on U-O-15 include a camera imaging device, transputer data processing units, and advanced European-made solar cells. Efforts continue to determine why it has not been transmitting, but the chances of recovery are dwindling.

UoSAT-F

Undaunted by the probable loss of U-O-15, the Surrey team is working on its replacement. After launch the new satellite will get an "OSCAR" number, but for now it is simply UoSAT-F. Many of the experiments of U-O-15 are being built again in the labs in England in preparation for launch this April on an Ariane rocket. Research Fellow Mark Allery G7DSY and others have been putting in long hours to finish the project. As if there weren't enough to do, the group must maintain operations on the current UoSATs.

The ground station at the University of Surrey was installed in 1975 to support control activities with AMSAT-OSCAR-6. It had only a few radios in a very small area so it did the job, but little else. By 1978 the system was expanded and was known as a "telecommand center" with several radios and an impressive automated antenna system using a modified Bofors antiaircraft gun mount. The antennas are still in use today, but other systems have been added. The custom tracking gear and connections to the university's mainframe computer have given way to 386 computers and arrays of displays for telemetry and tracking. Experimenters at Surrey continue to play a pioneering role in space education both in England and abroad, and at all education levels.

The ARSENE Satellite

Another satellite program developed for primarily educational purposes is the ARSENE satellite project from France (Ariane Radio amateur Satellite pour l'ENseignement de l'Espace). Many people have forgotten about this effort because of the delays and lack of information, but the project is still alive and may be launched in 1992 with the TELECOM-2B satellite as the main payload.

ARSENE was begun in the early 1980s and includes the Radio Amateur Club de l'Espace, Centre National d'Etudes Spatiales (CNES), 27 engineering schools, universities and colleges, and support from more than 40 companies. Student contributors number in the hundreds and the program has provided 87 engineering projects and one doctoral thesis.

The satellite is to be incorporated into the launch ring adapter between the main payload and the Ariane rocket. ARSENE is to act as a demonstration of how to accommodate secondary payloads with a minimum of mass increase and interface effort. It carries two transponders, one mode "B" (70cm up and 2 meters down) digital system, and an analog (voice, etc.) unit for mode "S" (70cm up and 13cm down).

The digital "B" system includes three distinct uplink frequencies and a single downlink using standard FSK modulation at 1200 baud. This configuration was chosen to allow standard packet-ready Earth stations access to ARSENE. The downlink transmitter runs 20 watts, so it should be easy to copy from modestly equipped stations.

The linear transponder with the 13cm downlink can be used with SSB, RTTY, CW or any other analog mode. Mode "S" on AMSAT OSCAR-13 transmits on 2401 MHz. ARSENE will come down around 2445 MHz. Current Mode "S" users will need to make appropriate modifications to make the 44 MHz move. Only one mode ("S" or "B") will be active at any given time. A schedule of operating times and modes will be determined by the STELA (Station de TELecommande Arsene) ground station. An onboard radiation dosimeter experiment is also included.

Physically, the satellite is nearly a cubic yard in volume, with a launch mass of 310 pounds. The orbit is to be elliptical with a perigee, or low point, of 12,430 miles; and an apogee, or high point, of 22,400 miles. This type of orbit yields a period of about 17.5 hours for one revolution around the Earth. The apogee boost rocket weighs 163 pounds and is made of carbon fiber materials. Spin stabilization will be around the "north/south" axis, and active attitude control (alignment relative to the Earth and sun) will be controlled by nitrogen gas jets. The power budget runs about 50 watts and the thermal control will be passive. Expected life is five years.

The ARSENE program has already contributed to the teaching of space technology. After launch it will continue that mission but will also provide the amateur community with a new space resource for communications experiments. 73

THIS ISN'T THE INVOICE FOR MY NEW MICRO-MINI HANDHELD --- THIS IS MY NEW MICRO-MINI HANDHELD!

Number 30 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge aa space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

FEB

COATESVILLE, PA Reservation deadline for the Dayton Hamvention Bus Tour is 2/28/91. $143 cost includes motel for 3 nights, and bus fare. The bus will leave for Dayton Apr. 25th at about 7 AM and return Apr. 28th. Contact *TRIAC ARC, PO Box 304, Coatesville PA 19320. (215) 269-4844.*

FEB 2-3

MIAMI, FL The 31st Tropical Hamboree Amateur Radio/Computer Show and ARRL Southeastern Division Convention will be held at the Dade County Youth Fair & Exposition Fairgrounds. Admission $5 advance, $6 at the door. Swap tables: $20 each plus registration. Power, $10 per user. 3 day campsites $40 (Fri., Sat., Sun.). 4 day campsites $55 (Thurs., Fri., Sat., Sun.). Headquarters Hotel: Miami Airport Marriott—$65 single, double. Call *(305) 649-5000.* Speak only to Reservation Dept. and mention "Tropical Hamboree" to get special rate. For brochure and reservation forms: *Chairmen, Evelyn Gauzens W4WYR, 2780 N.W. 3rd St., Miami FL 33125. (305) 642-4139. FAX: (305) 642-1648.*

FEB 10

MANSFIELD, OH The Mansfield Mid-Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds, beginning at 7 AM. Advance tickets $4, $5 at the door. Tables $9 in advance, $12 at the door, if available. Reservations must be received and paid by Feb. 1st. Talk-in: Call W8WE on 146.34/.94. For reservations send SASE to *Dean Wrasse KB8MG, 1094 Beal Rd., Mansfield OH 44905.* For info call *(419) 589-2415* after 4 PM EST.

FEB 16

MARLBORO, MA The Algonquin ARC will hold their Electronics Flea Market and VE Exams at the Marlboro Middle School Cafeteria from 10 AM-3 PM. Sellers set-up at 8 AM. Admission $2. Tables $10 in advance, $12 at the door. Wheelchair accessible. VE Exams start at 9 AM sharp. Pre-registration required. Send $4.95 check payable to *Mark Schneider WI1W, 14 Fuller Dr., Marlboro MA 01752. (508) 485-1857.*

RICKREALL, OR The Salem and Oregon Coast Emergency Repeater Associations will sponsor their 1991 Ham Fair at the Polk County Fairgrounds, beginning at 9 AM. Admission is $5 in advance, $6 at the door. Talk-in: 146.26/.86 repeater. Write to *1991 Salem Ham Fair, PO Box 784, Salem OR 97308,* or call *(503) 585-9554.*

FEB 16-17

SARASOTA, FL The Sarasota ARA wil sponsor its annual Hamfest/Computer Show at the Robarts Sports Arena. Free parking. Forums. Saturday's activities include a tour to Jungle Gardens. There will be a banquet at 7 PM. VE Exams Sunday at 10 AM. Talk-in: 146.910 repeater. Contact *Gene Marino, 4858 Tivoli Court, Sarasota FL 34235. (813) 355-0675.*

FEB 17

MELVILLE, NY The Long Island Mobile ARC will sponsor a Hamfest indoors at Electrician's Hall from 9 AM-4 PM. Admission is $5 at the gate. Exhibitors, $20 by reservation only. Talk-in: 146.25/.85. Contact *Neil Hartman WE2V, (516) 462-5549* or *Mark Nadel NK2T, (516) 796-2366.*

GOLDEN, CO The Aurora Repeater Assoc. will hold it's 10th Annual Swapfest at the Jefferson County Fairgrounds from 8:30 AM-2 PM. Contact *Judi WDØHNP, (303) 450-6910* or *Jan KA7TYU, (303) 680-8857,* or write: *Aurora Repeater Assoc., PO Box 39666, Denver CO 80239.*

FEB 23

ORANGE, TX The Orange ARC will sponsor its sixth Annual Hamfest-Flea Market at the V.F.W. from 8 AM-4 PM. Set-up at 7 AM. Tables $5 for individuals. $15 for dealers. Talk-in: 147.180+. Contact *Sherwood Buckalew KA5VOT, (409) 883-6111,* or *Dan Killough WB4GYS, (409) 769-9603.*

BURLINGTON, KS The Neosho Valley ARC will sponsor an Electronics Hobbyist Auction at the National Guard Armory beginning at 10AM. Set-up at 8 AM. Free admission. There will be a 10% consignment fee on all items purchased. Talk-in: 146.52 MHz. Contact *Bob, (316) 364-5448* or write to *V.A.R.C., Route 2, Box 38, Burlington KS 66839.*

BROOKSVILLE, FL The Hernando County ARA will hold its ninth annual Hamfest at the Hernando County Fairgrounds on US Hwy. 41 from 8 AM-3 PM. Free parking. Tailgaters' area available. Overnight parking permitted, but there are no facilities. Admission $3 in advance, $4 at the door. AMSAT seminar begins at 10:30 AM. Talk-in: 146.715/.115. Send check and SASE to: *Hamfest Chairman, PO Box 1721, Brooksville FL 34805.* For info call *(904) 796-4840 after 7 PM.*

FEB 23-24

CINCINNATI, OH The ARRL '91 Lakes Division Convention will be held at the Cincinnati Gardens Exhibition Center from 8:30 AM-5 PM Sat. and Sun. Advance tickets $6 (by 2/16/91), $8 at the door. Set-up from Noon-11 PM Fri. and 6 AM Sat. and Sun. Flea market tables, 8' x 4½' $15 plus general admission. Commercial "A" tables, 8' x 9', $50 each. Commercial "B" tables, 8' x 4½', $25. Contact *Stan Cohen WD8ODQ, (513) 531-1011* or *Joe Halpin W8JDU, (513) 851-1056.* Accommodations: *Quality Inn Central, Norwood OH, (513) 351-6000.*

FEB 24

DEARBORN, MI The Livonia ARC will hold its 21st annual LARC Swap 'n Shop Computer Fest at the Dearborn Civic Center from 8 AM-4 PM. Buy or sell amateur gear, computers or electronic test equipment. Free parking. ARRL/VEC Exams will be given by the Motor City Radio Club. Exam reservation deadline is 2/4/91. Call *Don Olzewski WA8IZV, (313) 294-4766* for exam appointments. Reserved table space 8' minimum. Talk-in: 145.35 repeater (-600) and 146.52 simplex. Send 4x9 SASE to *Nell Coffin WA8GWL, c/o Livonia ARC, PO Box 2111, Livonia MI 48151.*

CUYAHOGA FALLS, OH The Cuyahoga Falls ARC will sponsor their 37th annual Hamfest at the St. V. Center from 7 AM-3 PM. Wheel chair accessible. Advance tickets $3, $4 at the door. Tables $5 in advance, $6 at the door. Sellers may bring their own tables. Talk-in: 147.25 repeater (+600). Contact *Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223, (216) 923-3830.*

ROCK ISLAND, IL The Davenport ARC will celebrate its 20th year by hosting its 1991 Hamfest at the QCCA Expo Center. Doors open at 8 AM. Wheel chair accessible. For VE Exam info: *Al Broendel N9OK, 2712 38th St., Rock Island IL 61201.* Advance tickets $3, $4 at the door. Tables are $7 each. Contact *Dave Johannsen WBØFBP, 2131 Myrtle St., Davenport IA 52804.* Talk-in on the WØBXR 146.28/.88 repeater.

MAR 3

NORTHAMPTON, MA The ML Tom Amateur Repeater Assn. Fleamarket will be held at Smith Vocational School, starting at 9 AM. Set-up at 8 AM. Admission $2, under 12 free. Tables $12 advance, $15 at the door. Contact *Marvin Yale N1CDR, 6 Laurel Terrace, Westfield MA 01085, (413) 562-1027.*

MAR 9-10

CHARLOTTE, NC The ARRL Roanoke Division will hold the Charlotte Hamfest/Computerfair at the Charlotte Merchandise Mart. For information write to *Charlotte Hamfest & Computerfair, PO Box 221136, Charlotte NC 28222-1136.* To preregister call *(704) 536-7373.* For Dealer booth info contact *Robert Starling N4GVF, 7021 Holly Hill Rd., Charlotte NC 28227. (704) 568-7611.*

MAR 15-17

ORLANDO, FL The Orlando ARC will sponsor the Orlando HamCation and ARRL State Convention at the new Fairgrounds in Orlando. RV parking. Handicap parking. Advance tickets $6 (deadline Feb. 21st), $8 at the door. Swap tables $25. Tailgating $10. FCC Exams. For reservations: *The Orlando ARC, PO Box 547811, Orlando FL 32854-7811. (407) 657-9052.*

SPECIAL EVENT STATIONS

FEB 1-10

VERNON, B.C., CANADA The North Okanagan RAC will operate Station VE7NOR during the 31st annual Vernon Winter Carnival. Frequencies: 28.575, 14.275, 7.175 and 3.775. The "Winter Carnival Award" is free, but please send $1 or 2 IRC's (to cover the cost of postage) and either a QSL card or log info of a QSO with VE7NOR, to *Winter Carnival Award-VE7NOR, Box 1706, Vernon, B.C. V1T 8C3, Canada.*

FEB 2-3

VT QSO PARTY The Central Vermont ARC (W1BD) will hold a QSO party from 0001Z Feb. 2-2400Z Feb. 3. Frequencies: (Phone) 80-15 meters, the first 25 kHz up from the beginning of the General phone band edge; Novice 10 meter SSB portion. 50.110, 144.2. (CW) 3540, 3720, 7040, 7120, 14040, 21040, 21140, 28040. (RTTY) 3620 & 90 kHz from lower edge of other bands. Exchange-VT stations send RS(T) and CW two-letter county designators: AN, BN, CA, CN, EX, FN, GI, LA, OG, OL, RU, WA, WM, WR. Other stations send RS(T) and state, province, or ARRL country. Scoring-VT stations: 1 point per phone contact; 2 points per CW or RTTY contact. Multiply by number of VT counties plus states/Canadian provinces/ARRL countries (non-W/VE). Add 20 bonus points to total score for working W1BD. Other stations: 1 point per phone contact; 2 points per CW or RTTY contact. Multiply by number of VT counties. Add 20 bonus points to total score for working W1BD. Rules-A station may be worked three times per band; once each on Phone, CW, or RTTY sub-bands. No duplicate or repeater contacts. W1BD may be worked on each different band for bonus points; (Phone, CW or RTTY). Awards-Non-VT: Certificate to highest-scoring station in each state, province, country (non-W/VE). Vermont: Certificate to each station submitting a log. Plaque to highest-scoring VT station. Special certificates for highest scoring stations in CW, RTTY, HF Packet, SSTV, etc. W/VT Award to stations working 13 of Vermont's 14 counties. Send SASE now for official score and log sheets. SASE for results. Send logs/facsimilies, name, address, county (Vermont), NLT Mar. 1st, '91 to *D. Loverin WA1PDN, 50 Liberty St., Montpelier VT 05602* Note: 146.52 will be used for working VT counties at 9 AM and 9 PM EST, during the contest.

FEB 3

ANAMOSA, IA The Jones County ARC will operate Station NØCWP from 1200-1800UTC in celebration of the First Anniversary of the opening of the Lawrence Community Center. Phone and CW operation will be on the lower portions of the General sub-bands on 15, 20 and 40 meters, and the Novice portion of 10 meters. For QSL, send SASE to *NØCWP, Jim McClintock, PO Box 462, Morley IA 52312.*

FEB 9

AUSTIN, TX Station N5OWD will operate from 1400Z-2300Z to commemorate the 10th anniversary of The Armadillo BBS. Operation is in the Novice/Tech phone portion of 10 meters. For certificate, send QSL and SASE to *Ron Hawkins N5OWD, 1459 South Meadows, Austin TX 78758.* The Armadillo BBS, (512) 837-2003, answers 300-2400 baud callers and operates 24 hours a day in support of amateur radio/TV operators and others. It also contains a library of HAM-related files.

FEB 9-10

PHOENIX, AZ The Motorola ARC of Arizona will operate Station KB7FZC from 1500Z Feb. 9-0200Z Feb. 10, in commemoration of Arizona Statehood Day. The station will be based at Papago Park, near the tomb of George W.P. Hunt, First Governor of Arizona. Frequencies: CW-7.130, 14.050, 28.050; SSB-7.150, 14.280, 18.155, 21.380, 28.450 MHz. For an unfolded certificate, send a large SASE with your QSL card to *John Tucker KB7FZC, 2802 N. 34th St., Phoenix AZ 85008.*

FEB 11-15

NEW YORK The Fifth Annual School Club Roundup (formerly Operation SEARCH), is sponsored by the Council for the Advancement of Amateur Radio in the New York City Schools, the ARRL and its Hudson Division Education Task Force, to foster contacts with and among school radio clubs. The Contest will operate all week from 0800—2000 EST. Operate no more than 24 of the 60 hours. Logs must clearly show on and off times. Off periods must be at least 30 minutes. Classes: (I) Individual or Single Operator (non-club); (C) Club or group (non-school); (S) School Club or group (grades K-12). Exchange-Call sign, RS(T), class, US state or DX country. Scoring-No repeater contacts except satellite and "real time" packet. Stations may be contacted once each on phone and CW (Packet and RTTY count as CW). One point for each phone QSO. Two points for each CW QSO. Multiplier-Number of states plus DX countries plus 2x "C" class QSO's plus 5x "S" class QSO's. Final Score-Multiply QSO points by multiplier. Reporting-Sample log and entry forms are available for an SASE. Mail entries to *School club Roundup, c/o Lew Malchick N2RQ, Brooklyn Technical HS, 29 Fort Greene Place, Brooklyn NY 11217.* Logs must include exchange info, bands, and signature of all operators (and authorized club official or trustee). Dupe check sheets required for entries over 100 QSO's. Postmark by 3/18/91. Awards-Certificates for top three entries in each class. Special certificate for any station contacting ten or more school clubs. Send a large SASE or sufficient IRC's for complete results and more info about CAAR/NYCS.

FEB 14-17

LOVELAND, CO The Loveland Repeater Assoc. will operate Station KAØVFF (Valentines for Friends) from 1500-0500 UTC Feb. 16th and 17th, with some activity on Feb. 14th and 15th from 2500-0500 UTC. Frequencies: 25 kHz up from the lower portion of the General class phone and CW bands. Please QSL via *KAØVFF, Michael H. Walker, 3816 Ash Ave., Loveland CO 80538.* Send a SASE for your 8½" x 11" certificate commemorating Valentines Day from Loveland.

FEB 16-17

APACHE JUNCTION, AZ The Superstition ARC will operate Station WB7TJD in commemoration of Lost Dutchman Days from 1400Z-0200Z. Frequencies: 20, 15, and Novice section of 10 meters. Local contacts via 147.12 MHz. For special certificate and club QSL card, send 2 units postage on 8½" x 11" SASE to *SARC-WB7TJD, PO Box 1551, Apache Junction AZ 85217.*

FEB 22-24

WAIMEA, KAUAI The Kauai ARC will operate Station KH6HU from 2000Z Feb. 22-0600Z Feb. 24 to commemorate the landing of Captain James Cook. Frequencies: 25 kHz up on the General 80, 40, 20, 15, and Novice 10 meter phone bands. For certificate, send QSL and SASE to *KH6HU c/o KARC, PO Box 548, Kalaheo Kauai, HI 96714.*

FEB 22-MAR 10

FAIRBANKS, AK Station KL7KC will operate during the running of the Eighth annual Yukon Quest International Sled Dog Race. Frequencies: General portion of 80, 40, 20 and 15 meter bands; Novice portion of the 10 meter band. CW operation will be on or near 7.050, 14.050, 21.50, 28.200. QSL via *KL7KC, PO Box 81389, Fairbanks AK 99708.*

FEB 23

YUMA, AZ The Yuma ARES will operate Station N6RTV at 1500-2400 UTC to commemorate Amateur Radio Day 1991 in benefit of the International Red Cross. Frequencies: 10 meter Novice SSB-28.418 MHz; 15 meter General SSB-21.318 MHz; 20 Meter General CW-14.034 MHz. A unique certificate confirming communication with the internationally recognized Official Center of the World is offered to all amateurs submitting a QSL confirmation and 9" x 12" SASE to *Yuma ARES, c/o U.S. Post Office, Felicity CA 92283.*

Number 31 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

No Code

So. . .it's finally here. As we put the finishing touches on this issue, the FCC has announced the passing of a no-code license. Judging from what I've heard on the bands, most people are turning what is an elegantly simple solution to the no-code question into something much more complicated than it really is.

In a nutshell, here is the no-code license:

The no-code Technician license will retain all frequency privileges above 30 MHz (that's 6m, 2m, 220, 440, 1.2, etc).

The Technician test will consist of 55 questions.

Technicians will be given Novice HF privileges upon completion of a 5 wpm code test, administered by three volunteer examiners (the same way all upgrade tests are administered).

There is no change in any other license class. The Novice test and privileges stay the same, as do the General, Advanced and Extra. If a Technician wishes to obtain a General Class license, he would be required to take the 13 wpm code test, as well as the general written exam.

There will be no special call sign designation for no-code Technicians.

Current Technicians keep all HF privileges.

I must applaud the FCC for this simple solution to what has been an ongoing pain in the butt for them. It's a solution that makes an incredible amount of common sense. Coming from a government agency, I am stunned! Maybe we ought to let the FCC handle the deficit!

True to form, the ARRL is questioning the wisdom of letting these no-code Techs have 2 meter privileges. This smells of elitism on the part of the League (i.e., "Let's save 2 meters for us 'real' hams and put the no-code crowd up above 220 MHz, where we don't have to associate with them.") It also sounds like the League is a bit miffed over the fact that the FCC didn't adopt their idiotic and complicated proposal. Alas, the League's reaction is what we've come to expect from those old do-nothings in Newington.

Many hams are still bellyaching over this no-code license. Many still think that a code test keeps out the riffraff. People who use this argument must not spend too much time operating. Just listen to 75m phone some evening. How about the rude and discourteous operators on 10m, especially during contests? Let's not ignore the never-ending tirades of the looney tunes on 14.313. (At this point, don't you want everybody involved in that childish, egotistic baloney to just shut up?) A few of the 14.313 morons have made their way down to 40m, too. Since they all use callsigns, we may assume that they all have taken a code test. So much for the code keeping out the riffraff.

There's a whole other contingent (headed up by our buddies down in Newington) who don't mind having a no-code class of license—but put them up above 220 MHz (which translates into "keep 'em off of 2 meters"). With about two minutes of brain warming you can figure out how destructive this course would be. The only way to teach a new ham how to operate is to put him on the bands with other hams. If we put all no-code licensees up above 220 MHz, far away from the bulk of most amateur operating, it wouldn't be long until they became a separate group with their own way of doing things. This wouldn't necessarily be a bad thing, but it could degenerate into another CB-like situation. It is much better to put these new no-code licensees right on the most popular band—2 meters—and let them learn proper amateur operating practices (of course, this assumes that there are proper amateur operating practices on 2 meters for these new people to emulate).

Another complaint I've heard is that 2 meters is too crowded already. This new no-code license will just make it more crowded. Again, fire up those brain cells and you will soon realize how absurd this statement is. Sure, we have wall-to-wall repeaters on 2 meters. The entire North American continent is full of 2 meter repeaters. People who want to set up a repeater on 2 meters generally must wait for the owner of a current repeater to die before a frequency pair becomes available. The only problem is that most of these repeaters are silent. Nobody's using them!

Sure, every area has its most popular repeaters. Large population areas may have several well-used repeaters. Still, I defy you to prove that every repeater we currently have in operation in this country is being used. Even in major cities you can scan through dozens of repeaters and not hear a single voice for most of the day. We could quadruple the number of hams on 2 meters, and there'd still be room enough for everyone (unless you're a snob and don't want anyone but your little group of buddies to use your repeater).

Let's face it, folks. It's about time that amateur radio entered the '80s (I know it's 1991, but we must take it a step at a time). Morse code is a really fun way to communicate, but it is only one way, and not a very efficient way at that. What would you say if we required all licenses to be tested in SSTV. . .or RTTY. . .or packet. . .or EME moonbounce? They're all valid modes of communication. Why should we hang onto this antiquated mode of communications as an entry requirement? Most of us lose what little code proficiency we have 10 minutes after taking our test, so what's the point?

The question of no-code has been argued back and forth for over 10 years. We've all had our say. We've all heard just about every argument for and against. The FCC, after considering every viewpoint, has finally come up with a no-code license, and miracle of miracles—it makes sense! The time for arguing is now over.

Will a no-code license, by itself, be the salvation of amateur radio? No. Just about everyone who wants a ham ticket has been able to get one. Sure, we'll increase our numbers by a few percent, but will we see a surge of interest in this hobby? It's not likely. The problem has never been that people who want to be hams can't pass the code requirement. The problem is that most people have absolutely no idea what amateur radio is. It's a marketing and public relations problem.

Let's use this new license as a way to introduce amateur radio to the thousands of people we need to keep this hobby viable. Once we get 'em on 2 meters, let's get 'em hooked on HF so that they'll be motivated to learn the code and upgrade. The FCC has provided us with a great marketing tool. It's up to us to use it to our advantage. 73

Number 32 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

An Unpredictable Cycle

Old Sol fooled us again! For the past several months, we have been commenting about how the sun had apparently reached a plateau, and might even be headed down again. . . when surprise, surprise! During August 1990, the highest observed mean sunspot number of 200 for this cycle was noted, and the solar flux index reached a fantastic 295, marking an all-time high for Cycle 22.

At the time of this writing, in November, no one can predict for sure what the sun will do next. It may start down, go up, or stay constant. Whatever your favorite view, it's easy to say that Cycle 22 has been the most unusual cycle observed for at least a century.

Now: February's dismal prognostication. There will be some good days, around the 10th and the 23rd, when the HF bands will be jumping with signals for a few days. Otherwise, conditions will be "Fair" trending toward good or poor, as the chart shows.

Your best bet will be to consult WWV for the daily forecast at 18 minutes past each hour to get a better idea of solar flux and magnetic field conditions. You can expect "Good" conditions when the magnetic field "A" index is 10 or below, and the solar flux index is 175 or higher. Trends toward *lower* "A" numbers and *higher* solar flux numbers mean a trend to good DX.

February, as a pre-spring month leading to usually peak-DX conditions in March, will be a good one to watch. March should be the best DX month for all of 1991, and February might well turn out better than predicted. Let's hope so. . . . 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	20	20	–	20	20	–	10	–	15
ARGENTINA	[illegible]	[illegible]	[illegible]	[illegible]	–	–	–	–	10	10	10	15
AUSTRALIA	[illegible]	[illegible]	–	–	20	40	20	20	[illegible]	–	20	[illegible]
CANAL ZONE	15	20	20	[illegible]	–	40	–	10	10	10	10	10
ENGLAND	40	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	[illegible]	15	20	40
HAWAII	[illegible]	20	20	20	20	40	40	–	[illegible]	–	–	[illegible]
INDIA	–	20	20	–	–	–	20	15	–	–	–	–
JAPAN	15	20	–	20	20	–	20	20	–	10	–	15
MEXICO	15	20	20	[illegible]	–	40	–	10	10	10	10	10
PHILIPPINES	15	–	–	–	–	–	20	20	[illegible]	–	–	–
PUERTO RICO	15	20	20	[illegible]	–	40	–	10	10	10	10	10
SOUTH AFRICA	20	40	–	–	–	–	–	–	10	10	15	20
USSR	–	–	–	–	–	–	[illegible]	[illegible]	[illegible]	–	–	–
WEST COAST	[illegible]	[illegible]	15	40	40	40	–	–	[illegible]	10	15	10

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	[illegible]	–	–	20	–	–	20	–	–	–	–
ARGENTINA	20	20	20	20	20	–	–	–	–	10	[illegible]	[illegible]
AUSTRALIA	10	–	–	–	–	40	40	20	[illegible]	15	15	15
CANAL ZONE	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
ENGLAND	40	[illegible]	[illegible]	[illegible]	–	–	–	[illegible]	[illegible]	[illegible]	[illegible]	20
HAWAII	[illegible]	20	20	20	[illegible]	[illegible]	40	20	–	15	–	[illegible]
INDIA	20	15	20	–	–	–	20	20	–	–	–	–
JAPAN	[illegible]	[illegible]	–	–	20	–	–	20	–	–	–	–
MEXICO	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
PHILIPPINES	10	[illegible]	–	–	–	–	–	–	20	20	–	–
PUERTO RICO	20	20	[illegible]	[illegible]	40	40	–	[illegible]	[illegible]	[illegible]	[illegible]	15
SOUTH AFRICA	20	[illegible]	–	–	–	–	–	–	10	[illegible]	15	15
U.S.S.R	–	40	40	20	20	–	–	15	10	20	–	–

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	[illegible]	–	–	–	–	40	40	–	–	20	[illegible]
ARGENTINA	10	15	20	[illegible]	[illegible]	20	–	–	–	15	10	10
AUSTRALIA	10	20	20	–	–	–	40	–	–	15	–	–
CANAL ZONE	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	10	10	15
ENGLAND	–	–	–	40	40	20	–	–	[illegible]	[illegible]	20	20
HAWAII	15	[illegible]	[illegible]	20	–	40	40	–	–	15	10	10
INDIA	–	[illegible]	20	–	–	–	–	–	20	–	–	–
JAPAN	[illegible]	[illegible]	–	–	–	–	40	40	–	–	20	[illegible]
MEXICO	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	10	10	15
PHILIPPINES	10	15	–	–	–	–	–	–	20	20	20	15
PUERTO RICO	20	[illegible]	[illegible]	[illegible]	[illegible]	40	–	–	[illegible]	10	10	15
SOUTH AFRICA	20	20	20	–	–	–	–	–	–	15	[illegible]	15
USSR	–	–	–	40	20	20	–	–	15	20	–	–
EAST COAST	[illegible]	[illegible]	15	40	40	40	–	–	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

FEBRUARY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P–F	2 F
3 F	4 F–P	5 P	6 P–F	7 F	8 F–G	9 G
10 G	11 G–F	12 F–P	13 P–F	14 F	15 F	16 F–P
17 P	18 P	19 P–F	20 F	21 F–G	22 G	23 G–F
24 F–P	25 P–F	26 F	27 F–G	28 G		

73 Amateur Radio Today

MARCH 1991
ISSUE #366
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LETTERS

From the Hamshack

Pat DA2AA, APO NY Besides the issues in the early 70s when you were harping on the IRS, the Nov. 90 issue was among the best I have ever read! Keep 'em coming. I still remember our eyeball QSO here in Wiesbaden in May 1980. I was the guy sitting in the front row smoking cigarettes and drinking beer. . . .

And you're still alive? . . Wayne

Ben Bennett N7IVM, Bellevue WA I have just read "Never Say Die" in the December copy of *73*. As usual, when I read your column, I proceed cautiously, as I am never sure when something is going to leap out at me.

This time, however, I was unable to find any comments that I could disagree with. As usual, it seems as if the ARRL likes to start from behind the eight ball. The RSGB, of which I am also a member, has been working on this conference for at least three years, and they had no appeals for funds to help their effort. The inertia at the ARRL HQ is enormous, and I wonder whether you or I will live long enough to see much change. However, I am sure that that will not deter you.

Name withheld I've started writing some TV public service announcement spots that will target kids. As soon as they are finished, I'll pass them along for your input, and hopefully your support. I'd like these PSAs to be part of a larger campaign, with the spots serving to pique interest. Thanks for your encouragement. By the way, I spoke with some locals about this project and they thought that the ARRL should be the only ones to promote ham radio, that my ideas probably should be turned over to ARRL HQ, and that even if the spots were made, I'd never get them aired without ARRL endorsement (sigh). "Well," I replied, "if the ARRL wants to endorse them, great. If not. Who cares?" Wayne, I think you turned me into an unreasonable man.

How does the League manage to foster such complete idiocy? Your "locals" are certifiable nitwits. . . Wayne

Clifton Crews WD4MEI, Trussville AL Last night a neighbor of mine was in the shack. He is a CBer and a "sidebander." He is fascinated with packet and ATV, and is impressed with most of what he hears on 2m, but after listening to a little 75m phone, he said, "Man, on the lower side of 38 we wouldn't tolerate that kind of crap!" I almost split a side laughing.

I have listened in on some of his work on channel 38, LSB. It sounds like we all wish HF phone would sound. Well-behaved but slightly irreverent, interesting and well-done. This guy will make a fantastic ham without code . . . you see, he can't learn code. He's dyslexic, and code is just not in his brain's portfolio. All these years, he has been given the impression that he is not "good enough" to be a ham because of his inability to use code. I look forward to elmering him into a codeless Tech ticket, and working some ATV with him. He will be a better ham than most of the crotchety old guys crying doom and gloom.

Thaddeus A. Danley NZ3I, Eden Prarie MN I completely support the new code-free Technician license. Hopefully we will all work to welcome these new hams into the hobby.

Brett Breitwieser, Santa Cruz CA To celebrate the advent of the new no-code Tech license, I'm taking out a subscription to *73*. Thanks for the good work! I've been reading your mag for years. I'm 42 and a student of communications electronics at C.I.E., preparing for my radiotelephone op license. Now I'll get a new no-code Tech amateur's as well. Hope you will support the reality as you've supported the concept in the past.

This license is perfect for me since it's VHF/UHF I'm really interested in anyway, especially microwave. Let's get a bunch of new Techs and fill up those high bands before WARC! Would appreciate articles on proper procedures for new Techs and lots more VHF/UHF/microwave!

I see lots of signs of the usual stonewalling by the ARRL types on the computer nets and in the clubs. The new license is not for "real hams," it's a "boxtop license," etc. As though CW means anything anymore! Really laughable.

Let's make the new Tech license a real mark of distinction, real operator/builder/technicians opening up the microwave bands for the amateur community. Let's use the new license to juice up the amateur bands and help America regain its technological excellence.

Tuning the BBS: Ham #2 checks in on 2m after visiting ham #1 in intensive care. Ham #3 on the repeater asks, "How is he?" "Not too well. You should see all the tubes in him!" #2 says, "Gosh! All tubes. I didn't realize he was that old!" This brings a BBS response: That was shocking! Re-volting! Watt?!? At least that joke was current! *[They seem to use a lot of "Is" on BBSs.]* Another BBSer chimes in: We all take ohm-age to that joke. Do planar transistors sing "Ohm on the Range?" Where does the light go when it goes out?

Hmmm, bad as packet. . . . Wayne

A bad response to no-code from N0 Of course it was to be expected. Did anyone really think for a minute that the VHF bands wouldn't turn into a gigantic mess? And now that the feds have given 2m to the dogs, I hope that all of the no-code supports are feeling a bit like Judas. So much for saving 220 and 440, huh? Now all we need are repeaters set up exclusively for swapping recipes! Oh, well, there's always 10m FM.

To which a YL ham replies Excuse me? Going to the dogs? Swapping recipes? That's a sexist comment if I ever heard one. I'll have you know the examiner at my 13 wpm session said my copy was among the best he'd ever seen. I don't see how passing code is particularly more difficult than passing a 45-question written exam on theory. Depends on the person. If you listen to 14,313, those folks have all passed their code—many at 20 wpm! The problem with no-code isn't going to be people with a genuine interest in radio who did not like CW. The drawback will be people with an attitude problem who think that if they've passed a code exam that somehow makes them better operators than someone who hasn't. I hope you'll reconsider this CW bigotry.

Jonathan D. Armendariz, FPO San Francisco CA This letter is in response to your editorial in the Dec. '90 issue. It makes me glad that somebody has the same feelings I do. As an SWL, I passively listen to all the chaos going on, and it gets rather wild in my hometown (Los Angeles). I am not whining and crying, but as a prospective ham, is this what I have to look forward to? I want to be a ham because I love to communicate and make friends and hear from people of diverse cultures. However, if what I watch and listen continues, pretty soon there won't be much of anything left. Maybe the best we can do is to get together and try harder to think of some creative ways to get people interested, such as high school or college classes, new radio clubs, or maybe even a (GASP!) modified no-code license, something to get the young interested. Having the hobby dominated by old, closed-minded men shut to newcomers with new ideas, will cause its demise. All in all, wait till the ITU conference in 1992 and you'll see the shock on people's faces. After all, we are only hurting ourselves. I do appreciate the way you stand on your convictions, not being just another yes-man of the ARRL. I look forward to getting my ham ticket, but I'm concerned for what's ahead. *[This letter was written and answered before the FCC announced the new codeless license.—Eds.]*

If you'll notice—give it some thought—the worst mess on the air is coming from the least intelligent hams—chaps you don't want to waste a lot of time with anyway. Never mind 'em. Look for the hams with at least double-digit IQs and you'll do fine. . . . Wayne

Keith Baker KB1SF Soon after the FCC announced the long-awaited "codeless license," the following comments were heard on some local repeaters in the Dayton area: "Hate to see the code part go down the drain, we'll get all sorts of trash on the air now . . . Yes, maybe even them CBers . . . I suppose the bands will really be overcrowded now . . . Well, we can always go to 10 meters . . . They should give us regulars some new calls so we can tell us apart from them . . . There you go, they won't know beans about radio. . . ."

Count the number of "them's" and "they's" versus the "we's" and "us'es." These "concerns" about amateur radio have been around for years. I'm now firmly convinced we amateurs are afflicted with an almost universal phobia that ANYONE who enters the hobby AFTER ourselves is out to royally screw it up for those of US already here. I find it fascinating that WE weren't too concerned about these horrors when WE were trying to get our first tickets.

Face it: The real challenge facing amateur radio today is US! We talk about helping amateur radio grow. However, in our hearts, I believe many of us are doing our level best to erect barriers to keep THEM out. Have we ever stopped to think that THEM was US at one time? . . . Rather than erecting barriers for THEM, I suggest WE start making all our "growth" talk match our actions. How about becoming an elmer to one of THEM? When was the last time WE stopped by a Novice band to help a Novice or Tech with their code? When was the last time WE helped a newcomer put up their first antenna, or helped one of THEM set up their first shack, or answered THEIR questions about courteous operating practices? Who helped US get started in our hobby? Isn't it time WE returned the favor?

I suggest WE quit complaining, get off our collective finals, and start setting the example for our newcomers . . . before our new folks mistakenly assume the trash on 20 is the way it's supposed to be done! Inaction now may well seal the fate of our wonderful hobby. If we lose it, we'll only have US to blame!

Rick LaBrecque, Dixfield ME I recently passed my Novice and am diligently working toward Tech and General. I have an above average working knowledge of electronics, and feel each how-to article you print is great. Someone out there will say, "Boy, just what I was looking for," while the next guy will say, "Boy, I'd have to be a genius to build this gadget." We certainly can't please everyone.

What I would like to see is a Novice-Tech column EACH MONTH, with basics, such as learning code, building code oscillators, antennas, equipping the ham shack, proper grounding procedures. . . . I firmly believe that the Novice-Tech column is important, as is a General-Extra. . . . Not just a picture in the magazine showing kids or whoever just got their Novice ticket. Please talk this over, give it some thought, and keep it fresh in your mind, and keep it simple.

Rick, stay tuned. Wayne's got us working on a project that may be just what you're looking for. . . . David N1GPH

David N4YHC/AE, London KY Hello, I just thought I would send a quick note to tell you that I really enjoy your magazine. I have been getting it at the local bookstore.

Also, I wanted to say that I just passed Extra last night, exactly 364 days after I took my Novice test. I am 17 years old and a senior at my high school. I am one of three hams there. The other two are Techs.

I just wanted to tell you that the three of us are doing what we can to drum up some support for ham radio. Next week, we will be showing some video tapes and giving a brief talk in our physics class at my school. It seems that when everyone hears "radio," they think of channel 19 and that thing in their dashboard that puts out 100 dB. Anyway, we are doing what we can in our school paper to generate some interest.

David, I sure would like to see copies of what you're doing in your school paper. . . . David N1GPH

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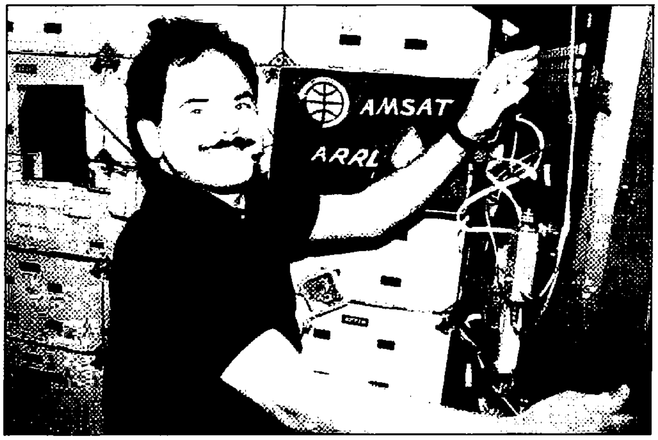

WA4SIR in space... *see p. 54.*

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NEVER SAY DIE

Wayne Green W2NSD/1

Avoiding Cancer

The recent American Cancer Society report on the connection between animal fat and colon cancer was almost enough to get some Big Mac customers' attention. ACS president Dodd said, "Studies indicate that as many as 80% of all cancers may be related to the environment and things we eat, drink and smoke."

I suspect the good doctor is being conservative. Within a few years, if he doesn't smoke, I expect him to upgrade that to near 100%. I know I'm eating plenty of fiber, very little red meat, avoiding smokers, smog and magnetic fields. Of course I could still get shot by the Mafia for screwing up their investments in the music and magazine distribution businesses, but that's a health hazard I accept as a trade-off.

Sure, I like rare beef. Love it. But not enough to sacrifice several years of my life for the pleasure. I truly feel sorry for nicotine addicts who know they are devastating the last few years of their lives, but still are unable to stop smoking. They know it means cancer, heart trouble, emphysema, endless oxygen tank rentals and a nursing home, but even so the addiction is too overwhelming for them to stop.

The impact of magnetic fields, which is finally getting some media coverage, is almost enough to get you to re-read my old killer blanket editorials. Some blanket manufacturers are paralleling their heating wires to cut down the 60 Hz radiation, but that doesn't reduce the destructive thermostat switching transients. Have you bought comforters and wool blankets yet? Moved your linear away from the operating position yet?

It's still macho for college students to drink beer. . .the more they can drink, the more the macho. Other than death by highway, I don't know any way to discourage that age-old rite. Kids live and die for macho, just like men. When we can convince kids it's stupid to smoke and stupid to drink, we'll be progressing. Kids hate being stupid. It isn't cool. But how can we get the message across when dad, their prime role model, smokes two packs a day and tosses down a six-pack while watching ball games on TV every night?

Food is my addiction, so I know what it feels like to crave a fix. It calls for every shred of moral fiber I can muster to keep from overeating. Show me a delicious, luscious homemade apple pie and I'll show you a truly desperate man. Quitting smoking can't be much more difficult than breaking the eating habit. Oh, the torments! It isn't hunger. It's like the kitchen has this enormous magnet. Every time my guard is down it exerts this black-hole-like attraction.

It was 19 years ago I decided to hell with being fat. No pills, no canned diets. . .just a 1500 calorie a day diet and I took off 85 pounds at about ten pounds a month. I'd seen too many people drop dead from losing weight too fast, so I took it slow and easy. And I've kept it off pretty well. It can be done, even by a foodaholic like me.

Now stop grumbling about me trying to reform you. Sure, I know that most of you will get mad at me for butting into your life. But if even 1% have the guts to change, I'm willing to live with the hate. All I want you to do is live longer, healthier and happier. I want you to make enough money so it isn't a problem. And I want to do everything I can to keep amateur radio going so we can all both enjoy it and use it to help our country regain its industrial and financial strength.

Now, for you fatties. . .oh, I see you waddling around the Hamvention with your big fat guts hanging out over your belt. Here's how I lose weight. Breakfast I have a glass of fresh squeezed orange juice, a bowl of All-Bran with a banana and whole milk. Lunch is a bowl of oat bran with a half slice of English muffin toasted and a half grapefruit. Dinner I have a boiled quarter of cabbage (with a little butter), a chicken thigh and some spinach (or broccoli, kale, collard greens, turnip greens). I cook the thighs (all fat removed) with lots of onions in white wine (add some red pepper for heat). . .mmmm. . .or broil 'em with curry powder on 'em. A little cranberry sauce spices it up.

Yes, I know, you thought you bought a ham magazine, not a health book. You'd prefer a nice big fried ham slice with candied (a little brown sugar) yams and a fried pineapple slice, right? Okay, but just on Friday night, then it's back to your diet. And don't gorge.

No snacks. No potato chips, Doritos or cheese balls. No beer. No Coca-Cola. You're drinking water now, and lots of it. Flush out that stuff which has been clogging your system for years. If you have to add something to the water, make it ice. Oh, okay, tea or coffee (decaffinated) is okay. Actually, green tea is supposed to be fantastic for you. I've got to get some.

You won't get hungry with that kind of diet. . .other than a psychic hunger. That's when you find out whether you or your own personal devil is stronger. It's "a" devil, not The Devil. He's busy down in Newington dancing with

Continued on page 61

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

QRX...

EDITED BY LINDA RENEAU KA1UKM

Bill to Protect Amateur Radio

On January 3, Rep. Jim Cooper (D-TN) introduced H.R. 73, a bill to prevent the loss of radio spectrum by the Amateur Radio Service. Cooper is a member of the House Subcommittee on Telecommunications and Finance, where the bill is likely to be sent for consideration. H.R. 73 is also known as the Amateur Radio Spectrum Protection Act of 1991.

The legislation proposes that "the Federal Communications Commission shall not diminish existing allocations of spectrum to the Amateur Radio Service after January 1, 1991. The FCC shall provide equivalent replacement spectrum to the Amateur Radio Service for any frequency reallocation after January 1, 1991."

ARRL President Larry Price W4RA welcomed Rep. Cooper's support of the Amateur Radio Service and expressed the hope that many congressmen will join him as co-sponsors.

Says Cooper: "I've come to believe that amateur radio operators are a valuable national resource, and I hope to see that they keep the necessary radio spectrum to enable them to be around for many years to come."

Congress found that (1) there are more than 490,502 licensed amateurs in the U.S.; (2) the amateur operates with a solely personal, nonpecuniary interest; (3) one of the basic purposes of the amateur is to assist in emergency communications; (4) amateur radio operators have reliably provided emergency communications; and (5) the FCC has taken actions (see the next news item) which resulted in the loss of over 100 MHz of spectrum to amateurs. *TNX ARRL via MCImail; HAMNET; and* W5YI Report.

220–222 Battle Lost

The fight to keep the lower two megahertz of the 1.25 meter band from reallocation appears to be over, and ham radio has lost. On December 5, 1990, the U.S. Court of Appeals for the District of Columbia Circuit denied the ARRL petition for review of the FCC order reallocating 220–222 MHz to the Land Mobile Service. In rendering its decision, the Court concluded that by law it had to give great deference to the views of the Commission. It also stated that it could not say that the Commission did not arrive at a reasoned decision about the best way to advance the public interest, convenience, or necessity.

The ARRL and the amateur community have no other legal recourse open to them other than clear legislation by Congress. Editor Art Reis K9XI of *220 Notes* spoke with ARRL General Counsel Chris Imlay N3AKD, and learned that the appeals court was the last stop in the legal process. The FCC is now in the position to set a date when hams must vacate 220—222 MHz.

Meanwhile, UPS is going to have to share the "new" 220-222 MHz "land mobile" band with the military. The Army requested and was granted an experimental license permitting its use of the entire 1.25 meter band. The Army plans to conduct basic research in buried mine detection in the Arizona desert using 2.918 megawatt ERP transmitters and sensitive receivers mounted in helicopters. Loral Corporation has developed the new system and will be overseeing the tests under the callsign KA2XAV, which expires on May 1, 1992. The signal bandwidth will be 10 MHz with a 100 nanosecond pulsed CW duration.

Before the 1979 WARC, the military informed the FCC that it would not require access to the 1.25 meter band after January 1990. Recent developments in the Middle East may in part be responsible for the military's decision to retain access. The type of research, and the geographical conditions under which it is being performed, make this appear very likely. *TNX* Westlink Report, *Numbers 591, 592.*

U2MIB On the Air

Soviet Cosmonaut Musa Manarov U2MIR, one of the first operators who brought amateur radio to space two years ago, is back on the air from *Mir*. During his last tour of duty, lasting 366 days, he spent much of his free time operating primarily on 145.55 MHz simplex FM.

A new packet radio setup is now operational on *Mir*. You can connect to Musa's BBS by the command *C U2MIR-1* when he is not operating live packet on 145.55 MHz. Also included is a voice synthesizer to transmit bulletins in Russian, German, and English. The *Mir* station uses a higher power multi-mode amateur transceiver than the one in SAREX operations, and the antenna is mounted outside of the space vehicle. These two items, plus *Mir's* 51 degree orbital inclination, make U2MIR's station accessible to most hams worldwide. *TNX* Westlink Report, *Number 592, and N6BVU.*

WAC with 50 mW

After building the FIRE-BALL transmitter from the November '90 issue, Mike Mayer W5ZPA of New Orleans set out to work as many countries as he could on 10m. Using just 50 mW on 28.060 MHz, Mike worked all continents in under 10 days! He now has a total of 16 countries and 20 states. Included in his list was a contact with the ZS9Z DXpedition at Walvis Bay, proving that you don't need multikilowatts to work those rare ones! *TNX K7IRK and WA6YPE.*

Half a Billion Miles...

On September 27, 1990, a new record for low power communications was set. Bill Brown WB8ELK, operating from the W2NSD/1 ham shack at *73* headquarters, successfully copied a 2.89 µW CW message on 28.638 MHz transmitted by Bob Moody K7IRK in Palestine, Texas. Bob was using a keyed HP-608D signal generator hooked up to a 3-element beam. Based on a distance of 1502 miles, this works out to over 519 million miles per watt.

Young Speakers Wanted

Carole Perry needs good speakers and presenters under 18 years of age for the Dayton Hamvention this April. She will be presenting "Youth in Ham Radio." She also urges every ham to bring a nonham child or young person to the Hamvention. Carole's address is at the top of her column, "Hams with Class," in this issue.

Satellite News

AMSAT-OSCAR-10 is supporting Mode B transponder operations. Apparently it is receiving sufficient solar panel illumination. The transponder may be used *carefully* at all points of the orbit except MA 254-006 when eclipses occur. If beacon or transponder signals show signs of FMing, users should cease all transponder use immediately.

Both of Fuji-OSCAR-20's transponders, JA and JD, have been turned on by the command stations. It was determined that transponder operation has little effect on the internal battery temperature.

Since mid-August, FO-20 has been in a non-eclipsing orbit, which means it has been constantly in sunlight. The battery temperature has risen to about 40°C. For normal operation, the battery temperature should be between 0 and 5 degrees. The command team for FO-20 will be monitoring the telemetry, and if they judge it necessary for the satellite's well-being, they may, without warning, turn off the transponders. *TNX* Westlink Report, *Number 591.*

TNX...

...to all our contributors. You can reach us by phone at (603) 525-4201, or by mail at *73 Magazine,* Forest Rd., Hancock NH 03449; and by e-mail on CompuServe ppn 70310,775, MCI Mail "WGEPUB" and the *73* BBS at (603) 525-4438 (300-2400 bps), 8 data bits, no parity, one stop bit.

QRX . . .

The SAREX STS-37 Mission

The STS-37 *Atlantis* mission, currently planned for early April 1991, will launch the Gamma Ray Observatory (GRO), the second of NASA's great observatories (the first was Hubble). Pilot Ken Cameron, a ham before becoming a NASA astronaut in 1984, is extremely enthusiastic about flying a SAREX experiment aboard his flight. He encouraged his fellow crew members to become hams, and all five astronauts now have their tickets.

The crew for the mission will be Commander Steve Nagel, pilot Ken Cameron, and mission specialists Jerry Ross, Jay Apt, and Linda Godwin. During the five-day mission that the crew will deploy GRO, Jay Apt and Jerry Ross will perform an EVA (ExtraVehicular Activity, or spacewalk) to evaluate Crew Equipment Translation Aids (CETA). These experimental space station "scooters" were designed to transport the astronauts from one portion of the structure to another, and to perform some mid-deck experiments, including SAREX. The SAREX STS-37 setup will use the same hardware and frequencies as the STS-35 setup, with the addition of amateur television.

On STS-37, live fast scan television (FSTV) will be uplinked from the ground on 70 cm. SSTV transmissions and reception to and from the shuttle will also be performed. NASA has been checking out a variety of portable home cameras for use aboard the shuttle. An 8mm Sony VCR/video camera will record the results from the mission's experiments. A Panasonic VCR/monitor, model PV-M429, will be used for slow and fast scan reception aboard the shuttle. The home model has been painted and wrapped in copper foil to reduce inflammability and EMI.

Since the Mir contact wasn't successful on the STS-35 mission, it will be a fairly important priority for STS-37. The crew's schedule may even be rearranged to make it possible.

Pilot Ken Cameron KB5AWP became an astronaut in 1984. STS-37 is his first shuttle mission. A Lieutenant Colonel in the Marines, he's clocked over 3,000 flying hours in 46 different types of aircraft. Since coming to NASA, he has worked on a Tether Satellite which will be launched next year. He's also worked on flight software testing, launch support at the Kennedy Space Center, and, appropriate for a ham, as CAPCOM (Capsule Communicator) for the STS-28 -29, -30, -33, and -34 missions. Besides ham radio, he enjoys flying, athletics, hunting, fishing, woodworking, and reading.

Commander Steve Nagel N5RAW first flew as a mission specialist on the STS-51-G mission in July 1985. Three satellites and a free-flying platform were launched. He was also a pilot on the German Spacelab D-1 mission, 61-A, In October 1985. Challenger's last mission, it carried a record eight people into space. When he flies as the commander of STS-37, he will become the first person to have flown aboard the shuttle in all three positions.

The all-ham crew of STS-37: Seated (l to r) are Ken Cameron KB5AWP, Steve Nagel N5RAW and Linda Godwin N5RAX. Standing (l to r) are Jay Apt N5QWL and Jerry Ross KB5OHL.

Mission Specialist Jerry Ross (who will be getting a new callsign) flew on *Atlantis*'s second mission, 61-B, in November 1985. The crew deployed three communications satellites and performed in-orbit drug manufacturing experiments. But the highlight of the flight was a spacewalk by Jerry and astronaut Woody Spring. They built two large, experimental tinkertoy-like structures for evaluating crew assembly procedures which may be used to build NASA's permanent space station in the future. Jerry's second mission was the *Atlantis* STS-27 secret defense department mission in December 1988 that deployed a radar spy satellite. By coincidence, Jerry closed the airlock hatch on the last U.S. spacewalk back in 1985, and he will open it back up on the next spacewalk, STS-37's CETA experiment.

Mission Specialist Linda Godwin N5RAX joined NASA in 1980 as a flight controller and payloads officer for several shuttle missions. Before joining NASA, Dr. Godwin, a rated private pilot, taught physics at the University of Columbia in Missouri and received several assistantships to conduct research in low temperature solid state physics. Selected by NASA in 1985, Dr. Godwin became an astronaut. She has worked with flight software verification, mission development, deployable loads, and Spacelab payload integration. STS-37 will be her first spaceflight.

Mission Specialist Jay Apt N5QWL worked for NASA's Jet Propulsion Laboratories in Pasadena, California, from 1980–82 in their Earth and Space Science Division as a scientist for the Pioneer Venus mission. In 1985, he became an astronaut. During his early days as an astronaut, one of Dr. Apt's jobs was to set up crew procedures for deploying and repairing GRO. He was lucky enough to get assigned to deploy GRO as his first shuttle assignment.

Compared to earlier shuttle ham experiments, STS-37 mission activities are more flexible. Since it isn't a Spacelab mission, the crew will wake and sleep at the same time, instead of working on different shifts. With a more relaxed schedule, the crew will have more time to take in the view, and hopefully, more time to operate SAREX. With an all-ham crew, it's possible that SAREX will be operated almost continuously in either voice or packet mode.

Based on a preliminary flight plan with an April 8, 1991 launch date at 14:14 GMT, the *Atlantis*'s orbital parameters will be:

Shuttle#	STS-37
Element Set	JSC-002
Epoch	91098.6250
Inclination	28.4632
RAAN	240.1995
Ecc	0.0006984
Arg Perigee	279.2831
Mean Anomaly	332.4544
Mean Motion	15.37981811
Decay Rate	2.3 E-04
Epoch Rev	1

TNX Philip Chien.

See Philip's article "Hams in Space" in this issue.

Packet with the Microsats

The secrets of success.

by David Medley KI6QE

Many of us have had problems understanding the new microsat technologies and putting the hardware together to ensure success.

This is the account of one old ham who has achieved success through dogged determination and the old ham approach of trying something until you find out what works. Another approach is to ask an expert, but sometimes it's difficult to find the right expert. Here are some hints to help you get the most out of orbiting packet!

The specific equipment covered here is probably typical of many ham shacks. The transceiver is a Yaesu FT-736R with a PK-232 TNC, and a TAPR PSK modem and disconnect. The antenna system is a homebrew quagi driven by a Kansas City Tracker and an old IBM PC/AT.

Receive UO-11 Telemetry with your PK-232

This simple modification will allow you to copy the telemetry text directly from the University of Surrey's UoSAT-OSCAR 11.

UO-11 downlinks its telemetry via 1200 baud ASCII with an inverted bit format on 145.825 MHz FM. Reinhardt Richter DJIKM came up with a modification to the PK-232 which will receive this format.

The modification consists simply of using an unused inverter in the PK-232. You install a small switch to move this in and out of the circuit. See Figure 1; the procedure is as follows:

1. Solder a jumper wire between U-15, pin 6, and U-15, pin 1.
2. Break the circuit board trace connecting U-15, pin 6, and JP-4 at "A."
3. Mount an SPDT switch on the front panel. The right-hand side above the power switch is suggested.
4. Connect the center of the switch to JP-4.
5. Connect one side of the switch to U-15, pin 2.
6. Connect the other side of the switch to U-15, pin 6.

When the newly added switch is in one position, the PK-232 will receive normally. When it's in the other position, all data received by the PK-232 modem will be inverted before reaching the 8530. This is essential for receiving UoSAT 11, and you will need to make some parameter changes to the PK-232 as follows: **MODE ASCII, ABAUD 1200, WIDE ON, MFILTER $80,** and **AFILTER ON.**

The AFILTER is only available in PK-232 units with the 1989 firmware. If your unit does not respond to the AFILTER command, just ignore it. It will still work fine with the UoSATS.

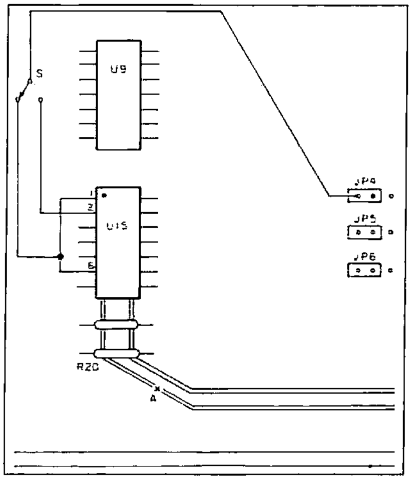

Figure 1. PK-232 modification for UoSAT-11 telemetry reception.

The TAPR PSK Modem

This sophisticated little unit comes from Tucson Packet Radio in kit form. Except for a few exceptions noted below, the instructions are well-documented and clear.

If you follow the instructions carefully, the unit should work. However, there are a few points to consider.

Because all the packet microsats use Manchester coding for the uplink, the left-hand switch on the modem must be "up" in the MAN position.

Next, the loop-back tests on page 40 of the instructions are merely to confirm that the Manchester circuitry is functioning. Do not infer from this test that the loop must lock at 9600 bps when receiving satellites. This is simply not the case; the loop always locks at 12.8 kHz when in the operational mode.

This misunderstanding is compounded by an error on page 41 of the TAPR instructions. The sixth instruction reads, "With a frequency counter at TP2, adjust R80 for a reading of 12.8 kHz." As R80 merely sets the internal clock in the modem, you can turn it all day without effecting the frequency at TP2!! If you substitute R33 for R80 in the instructions, all becomes immediately clear. Do not touch R80 under any circumstances once you have set it in accordance with the instructions on page 31.

If you are still having difficulties with these adjustments and loop-back tests, try changing the 4046 PLL chip at U-6. Of those tried, Motorola's 4046 chips have been the most successful. You can get them from JIMPAKS, Radio Shack, or electronic parts supply houses.

When adjusting the AFC "dead band" as described on page 31, be careful to get this as accurate as possible. Remember that the FT-736 will track in 10 Hz steps, so you don't want the "dead band" to be too wide. 25–30 Hz has been found to be a good choice. For the FT-726, this needs to be wider to accommodate the 25 Hz steps. If the modem tracks with the tune indicator not centered, try small adjustments to R61 while copying live data from a satellite, and recheck the "dead band." Best operation is obtained when the TAPR modem loop is properly centered.

When wiring the modem, you'll be asked at specific points to decide whether your unit is a TNC-1 or a TNC-2. The PK-232 has the same clock arrangement as the TNC-1. Especially note page 23 of the instructions. Be sure the orange wire is connected to pad 2 if you are using a PK-232.

The interconnection cables are straightforward—if you can call putting on DIN connectors and 8-pin mike plugs "straightforward"!! Follow the instructions for the FT-726R on page 44 and be sure you make up the cable to connect between the modem TNC audio outlet and the PK-232 radio outlet. When completed, you should have the following connections:

1. From TNC Data to the modem disconnect.
2. From TNC Audio to the radio 1 (or 2) outlet on the PK-232.
3. From the VHF and UHF connectors on the modem, a single 6-conductor, shielded cable connecting to an 8-pin mike plug and a phone jack on the front of the FT-736. The connections for the 726 are similar.

When putting on these connectors, hold the connector body in a vice, as you need both hands free for the job. Avoid too much heat, which can damage the insulating material on the connectors. If you use the high-quality DIN connectors supplied by TAPR, the cable will fit tightly inside the rubber boot. A little petroleum jelly on the cable solves this problem nicely.

Before actually trying to receive live material off the air, it's useful to try the system out with an audio tape. You can get one from AMSAT at a modest cost.

The most useful is one which has AO-13

Microsat Frequencies

Microsat	Downlink	Uplink	Comments
UO-14	435.070	145.975	9600 bps FSK (FM) up & down
(UoSAT-14)			1200 bps AFSK (FM) up & down
AO-16	437.026	145.900	1200 bps BPSK (SSB) down
(PACSAT)			
	437.051	145.920	1200 bps AFSK (FM) up with AX.25 Manchester encoding
	2401.143	145.940	
		145 960	
DO-17	145.825	None	1200 bps AFSK (FM)
(DOVE)	2401.22		
WO-18	437.075	1265 ATV	1200 bps BPSK (SSB) down
(WEBERSAT)	437.102		Fast Scan Video up
LO-19	437.125	None	CW Beacon
(LUSAT)	437.126	145.840	1200 bps BPSK (SSB) down
	437.154	145.860	1200 bps AFSK (FM) up
		145.880	
		145.900	
FO-20	435.910	145.850	1200 bps BPSK (SSB) down
(Fuji-OSCAR)		145.890	1200 bps AFSK (FM) up
		145.910	

telemetry on one side and Fuji-OSCAR transmissions on the other. The AO-13 material is not germane to this discussion, but the Fuji material is of considerable value. Feed the output of the tape recorder directly to the phone plug on the cable going to the modem.

Fire up the PK-232 and you should be receiving FO-12 material without any trouble.

The Right Settings

Now we are ready to get on the air. The first thing to do is to re-configure some of the parameters in the PK-232. The following has been found successful: **DWAIT 32, FRACK 6, FULLDUP ON, HEADERLN ON, MAXFRAME 2, PACLEN 32, PACTIMINT 10,** and **TXDELAY 64.** On the TAPR modem, the left-hand switch is "up" or on MAN, and the next, center. Then the next is "up" or ON, and the right-hand switch is "up" or JOINT. Set the audio gain control on the radio so that the left-hand bar display on the modem is around the 7th or 8th bar. Tune in the microsat downlink until the right-hand bar display indicates that the loop is centered. (When you were adjusting the modem, you determined which bar would indicate this.) An oscilloscope connected to the PK-232 is a great help, and if you have a suitable one you might consider leaving it as part of the permanent installation. I use a Kenwood SM-220.

Put the loop-centered switch in the STEP switch to either USB or LSB, depending on your receiver tuning. Use whichever setting tracks correctly. The loop should remain centered throughout the satellite pass, and should not flicker either up or down. If it does, your "dead band" is too wide.

If all is well, you should now be receiving the downlink perfectly. First, try connecting to your station through either Pacsat or Lusat. For example, **KI6QE V** LUSAT-1. Keep the transmitter output to 20 watts or less, and use the FM-N position on the FT-736. If you are using an FT-726, be sure the deviation is less than 3 kHz. You should connect almost immediately. Be sure you are using the correct uplink frequency; see the table. You don't have to track the uplink frequency for Doppler since the microsat has sufficient bandwidth to compensate. However, if you are a purist, you may want to adjust the uplink frequency at the beginning, center, and end of the pass to maintain continuous connect.

Now you can try FO-20. First, tune in the downlink as before on 435.910 MHz, then try to connect with the Mailbox. Use the callsign 8J1JBS. Please note that there is no digipeater, so do not try to connect to yourself. It won't work. When you get the connect, wait for the prompt **JAS>**. If you issue a command before this, you'll get frame-reject responses, and you'll have to disconnect and start again. Pressing **H** will bring a short help screen, and you can go from there.

All these packet microsats have four uplink frequencies. You can select the appropriate uplink frequency in accordance with the following formula, suggested by HB9AQZ to avoid congestion on the uplinks: 1. If your callsign ends in a letter from A-G; 2. if your callsign ends in a letter from H-M; 3. if your callsign ends in a letter from N-T; and 4. if your callsign ends in a letter from U-Z.

Now, a word about the FT-736 radio. It has a small jack on the back that short-circuits most of the audio processing circuitry. This DATA IN/OUT jack is well worth using for the FM data input from the PK-232. Instead of connecting from the TAPR modem to pin 8 on the mike connector, take it to the sleeve of a miniature stereo connector and plug this into the above jack. Don't forget to include a ground connection as well.

You will be surprised at the improvement in your uplink performance. Connection is usually achieved at the first or second attempt, and through-put is as good as or, in many cases, better than with the local terrestrial BBS. You can even do better than this by taking this connection directly to the junction of R32 and C39 in the TX unit of the 736, but unless you are willing to get into your new and expensive radio with a soldering iron, I suggest that you forego this dubious pleasure, and put up with the "substandard" performance as described above.

The Software

A number of packages are available. Most of us start with a simple communications program, such as PC-TALK or PROCOMM, to interface the computer and the PK-232. This is adequate and flexible, but you have to set things up and remember key commands. PC-PAKRATT from AEA conveniently automates most of the functions you need, but it's hard to modify, and it hasn't been updated for the latest developments.

For example, if you want to use KISS or some of the newer commands, you have to resort to dumb terminal mode, which has no real advantage over the simpler communications programs above.

A newer shareware program called LAN-LINK retains most of the automation of PC-PAKRATT while keeping the flexibility of the simpler programs. You can obtain this from many BBSs and CompuServe.

The Quagi System

The installation described uses a dual home-brew quagi system with 2 x 9 elements on 2 meters, and 2 x 16 elements on 70cm with auto tracking, as already indicated. Others have obtained perfectly satisfactory operation with vertical antennas for both transmit and receive. If you choose to go this route, be prepared to put more RF power into the antenna; you'll need at least 100 watts EIRP. If reliable performance is your goal, experience indicates that perhaps 200 watts EIRP is a better figure.

Finally, what about all that neat telemetry that pours onto our screens? What does it all mean? It's a running commentary on the health of the satellite. There are programs to decode this data into more meaningful numbers. A program called TLMDC is available from some BBS facilities as well as from AMSAT. This decoder requires your PK-232 to be in KISS mode to operate properly. TLMDC takes binary data from the downlink and writes it directly to disk, or decodes it to the screen or another disk file. KISS is available on all PK-232 machines. However, if you don't have the 1989 firmware, you need to change the following parameters to get into the KISS mode: **KISS ON, HPOLL OFF, PPERSIST ON, RAWHDLC ON, CONMODE TRANSPARENT,** and **HOST ON.** If you have the 1989 firmware in your PK-232, all you have to do is type **KISS ON** at the CMD prompt.

As soon as you have entered these parameters, exit the communications program and bring up TLMDC by typing **TLMDC COM1:1200,n,8,1.** You will be able to see the actual telemetry in meaningful numbers.

Another program, WHATS-UP, is available from Joe Kasser G3ZCZ at P.O. Box 3419, Silver Spring MD 20918. It doesn't require KISS, having its own communications program, and it's probably the best way to go if you are just starting up.

There are two land-line BBSs which carry AMSAT news and the software referred to in this article. The official AMSAT board is operated by the Dallas Remote Imaging Group at (214) 394-7438. In Southern California, the California Astronomers Group has a section in their BBS, phone number (714) 738-4331, for AMSAT; it carries the same material as the Dallas BBS. I'd be more than happy to assist you with problems in similar systems; you can write to the address below, but please send an SASE with your request.

Since this article was first prepared some dramatic new developments have taken place in the Microsat World. Both LUSAT (LO-19) and PACSAT (AO-16) have new BBS software loaded and operating. To take advantage of these very advanced technology satellites you will need the following software packages in your ground station. These are obtainable from AMSAT.

PB.EXE This program allows you to copy broadcast bulletins, etc.

PG.EXE This allows you to get a file directory and to up and download files.

PFHADD.EXE This prepares files for uploading. You cannot upload without first using this utility.

PHS.EXE This processes downloaded files and allows you to display their contents.

It is important to note that PG requires your TNC to be in the TRANSPARENT mode, whereas PB requires KISS mode. This causes PK-232 users some inconvenience in switching from one program to the other whereas if you are using a TNC-2 this is not so.

This is a fast developing field so keep your eyes on the AMSAT Bulletin Boards. In particular, watch the 75-meter nets on Tuesday evenings on 3.840 kHz.

David Medley KI6QE was first licensed in Australia as VK3MJ in the '30s. He emigrated to this country with his family in the early '60s to work for the Collins Radio Company in Dallas, Texas. He retired in 1987. You may contact him at 1450 Bayview Heights Drive, Los Osos CA 93402. Again, please include an SASE.

Weather Satellite Reception

Dust off your unused scanner.

by John E. Hoot N6NHP

A number of years ago I became interested in receiving images from weather satellites. There are plenty of articles on this topic, and manufacturers of inexpensive computer systems for displaying vivid Earth images, but few tips on receiving the birds. After reading some of the NASA and NOAA specifications from the satellites, I concluded that none of my current gear was going to be satisfactory.

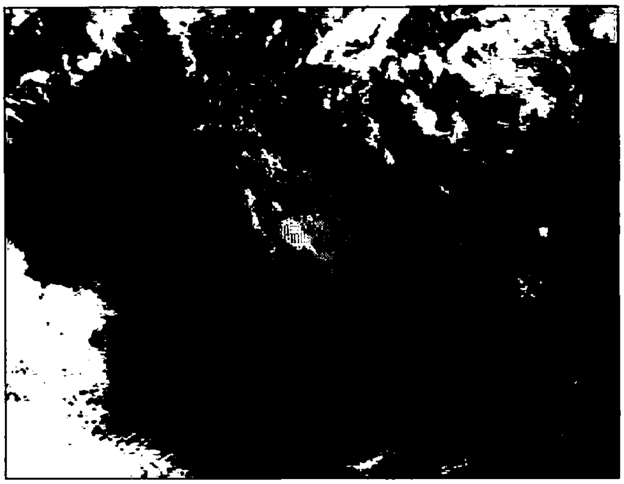

Photo A. With a little work, you can modify a used scanner to pick up the weather satellites.

Circumpolar Satellites

Polar orbiting satellites broadcast FM signals on frequencies between 137 MHz and 138 MHz. The problem for me was that these satellites have a total deviation of 30 kHz. Then, add to this, ±3 kHz of Doppler and transmitter stability guaranteed to about ±3 kHz. I figured I needed an IF about 42 kHz wide to do the job.

The calculated IF bandwidth meant that my NBFM receivers would be badly over-deviated. Any signal audio would be badly distorted and break up. With WBFM equipment, the weak signals would be lost in the noise. Despite the analysis, my curiosity led me to set my NBFM scanner to listen for the satellites.

As my analysis predicted, when I got the signal, it was over-deviated. The brighter the image transmitted, the higher the modulation index and the noisier the signal. But there was enough promise in that to get me thinking.

IF Discovery

I tuned a better receiver up to the same frequency, and to my surprise, the audio was worse. After some reflection, and a little time with a scope on the bench, I had the answer. The sharper IF filters in the good radio were attenuating the wide signal more than the cheap scanner I used initially. I sat down with a block diagram of the scanner to see what I could do to widen the IF for weather satellite work. The problem turned out to be pretty easy to solve. I discovered that with a little work, most synthesized scanners can be modified to perform well as weather satellite receivers.

Figure 1 shows how most modern, keyboard programmable NBFM scanners have been designed. You can often pick up a working unit at a swap meet for under $75. A new unit may only set you back $125. And, as I indicated, it only takes a little work to make it perform as well as dedicated satellite receivers that cost five to ten times as much. It's best to convert a lower-cost scanner with just NBFM capability since the more expensive units already have wideband FM (although they are too wide) and will not perform well after modification. If your scanner already has wideband FM capability, just add a good preamp for reasonable performance.

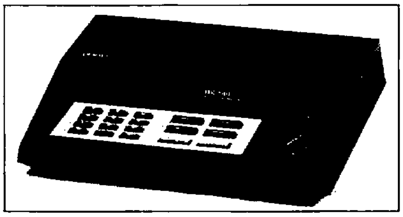

Photo B. The Uniden BC-145 scanner modified for weather satellite receive.

The Scanner Modification

Most scanners are dual-conversion receivers. They have two RF front ends: one dedicated to UHF reception and the other to VHF reception (see Figure 1). After the RF stages, both signals are mixed with signals from the PLL-controlled oscillator to produce a 10.7 MHz IF signal.

Using an analog multiplexer, the microprocessor selects which of the mixer outputs to feed through to the rest of the receiver. Since we are only interested in 137 MHz signals, we only need to worry about the VHF section.

Typically, the scanner uses a simple crystal filter at 10.7 MHz. Check the specifications of your unit's filter; refer to the part number. Most of these crystals are designed for WBFM gear, so they will have a 3 dB bandwidth of ±120 kHz. As long as the filter has a bandwidth of ±25 kHz or more, you won't need to replace it. If you do have to replace it, you can easily find a replacement in a junk FM broadcast receiver or you can order one from an electronic supplier for a few dollars. Suitable units include Tokyo America SM07M3-A0-20 from Digi-Key for $2.10.

After the first IF, the receivers will have a second local oscillator that will mix the 10.7 MHz down to 455 kHz. After the second mixer, you'll find a 455 kHz ceramic lattice filter. This component narrows the bandpass of the FM. These filters typically are ±10 kHz with very sharp skirts. If the first IF crystal filter is narrow enough, this filter can be removed and replaced with a small value (0.01 μF) bypass capacitor. Alternatively, you may wish to replace it with a wider ceramic filter. Suitable units include MuRata Erie CFM455A for about $13.

As a specific example, I've modified a Uniden BC-145 scanner. The 455 kHz ceramic filter is a Murata SFR-450D. It's an orange colored device labelled "part number FT-2," sitting next to the MC3359P IC. I removed this filter and replaced it with the 0.01 μF capacitor as shown in Figure 2. If you have trouble finding which are the in and out leads for you filter, just trace the leads from pins 3 and 5 (input and output) of the MC3359P.

Sweeping Up

Once you have replaced or bypassed the second IF filter, you will need to realign the

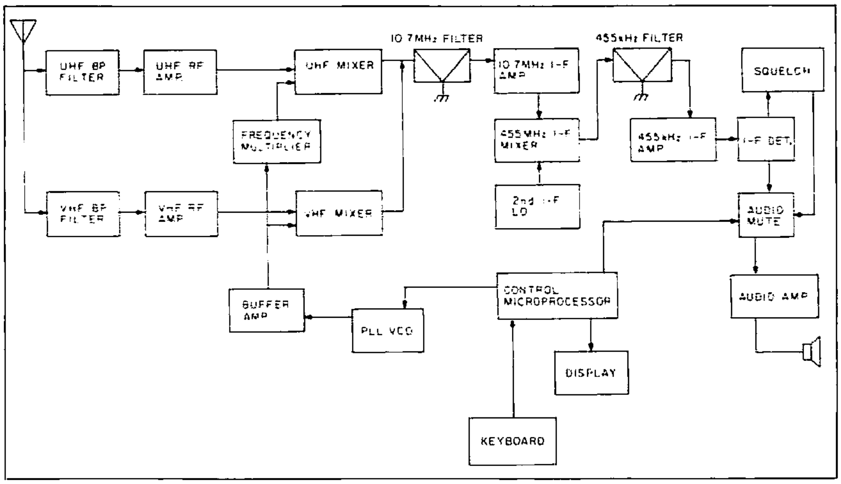

Figure 1. Generic FM scanner block diagram.

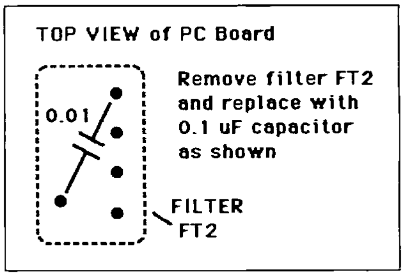

Figure 2. Pinout of the Murata SFR-450D filter showing the in and out pins. Remove the filter and replace with a 0.01 μF capacitor where shown.

receiver. If you have a sweep generator, you can set the bandwidth to ±22 kHz, and adjust the IF transformers for flat response over the new passband.

If you don't have a sweep generator, do not despair. Get a 2 meter handheld and run it into a dummy load near the scanner. Since every scanner I have seen that covers 137 MHz FM also covers 2 meters, you can use the HT as a signal generator. Program the handheld in kHz steps to 144.500 MHz through 144.550 MHz. Stepping through the memories while transmitting is nearly as good as a sweep. You do not even need a scope. An RF voltmeter or oscilloscope connected to pin 5 of the MC3359P is good enough for the alignment. Again adjust the IF for a flat response across the desired passband. In the case of the Uniden BC-145, just tune L5 and L6 in the first IF stage slightly until you achieve the desired bandwidth.

After the adjustment, you should find that the satellites give good clean signals throughout their passes. Also, the scanner still functions reasonably well with NBFM signals, since a strong signal will force out adjacent signals.

You can also receive WEFAX from GOES and METEOSAT geostationary weather satellites by using a converted scanner with a 1691 MHz to 137 MHz downconverter.

If you're tired of listening to police calls, or have a dusty scanner lying around, put it to a new use. Spend an hour on this project, and be ready to chase down some impressive satellite images. [*Ed. Note: A completely modified and aligned Uniden BC-145 scanner as well as a lineup of IBM PC interfaces and programs for FAX, RTTY, SSTV and weather satellite receive are available from the author.*] 73

John E. Hoot N6NHP may be reached at Software Systems Consulting, 150 Avenida Cabrillo-C, San Clemente CA 92672. Telephone (714) 498-5784.

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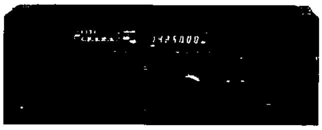

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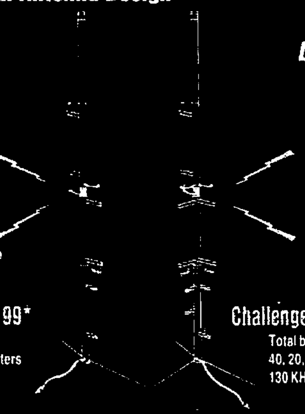

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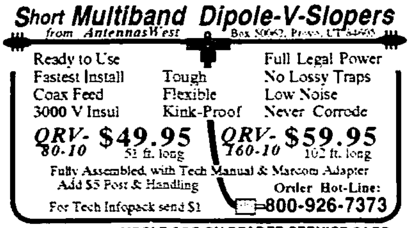

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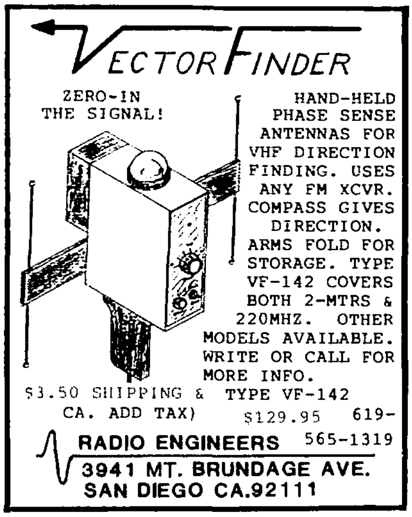

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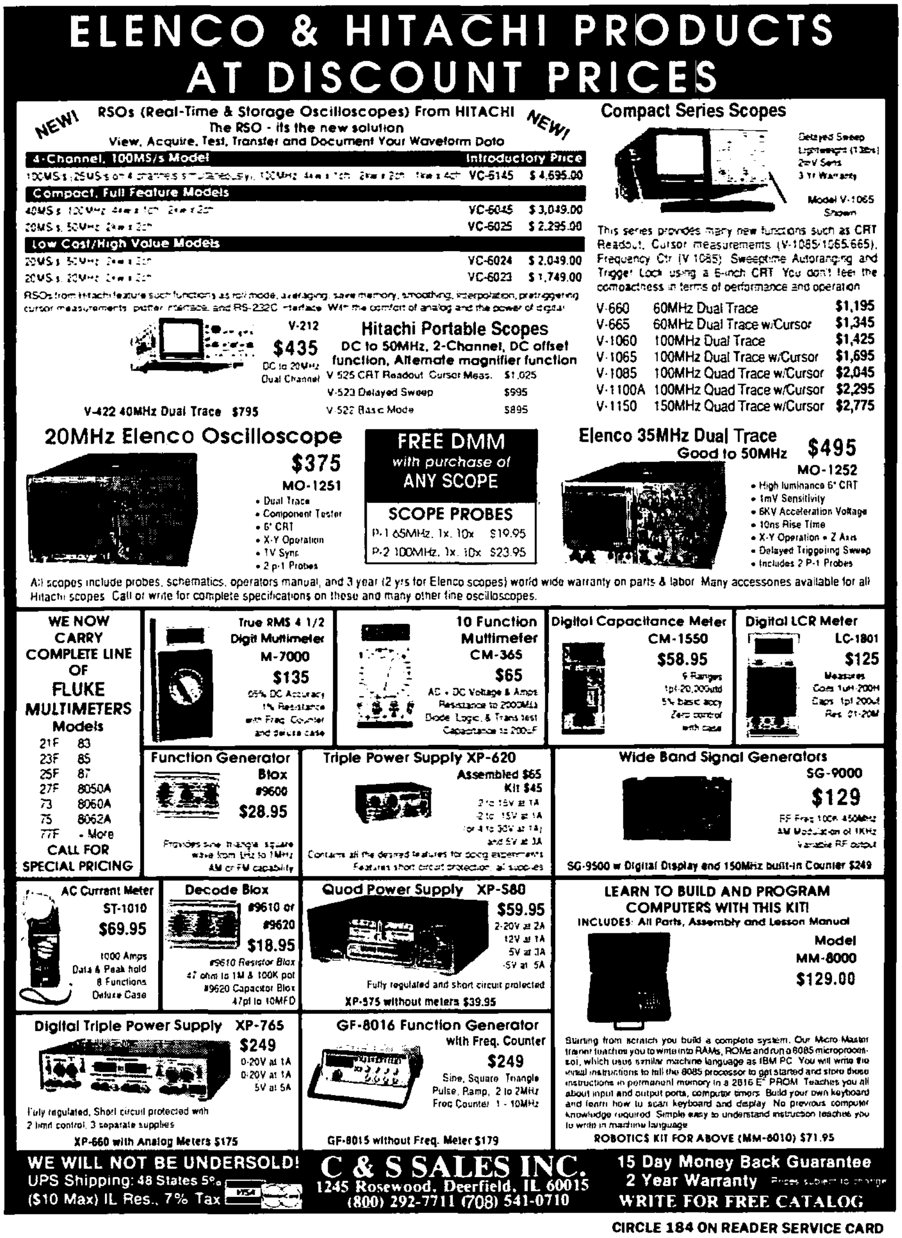

CIRCLE 184 ON READER SERVICE CARD

The Desert Voices Project

An overnight success story.

by Linda Reneau KA1UKM

At a de-commissioned NIKE missile site about 35 miles southeast of Minneapolis, Minnesota, station AAR5NSF of the Desert Voices project is busy handling phone patches, packet BBS messages, and MARSGRAM communications between U.S. Service people and their families and loved ones in the Middle East. The U.S. Army has recognized the Desert Voices project as an officially sanctioned Army MARS station operating under the guidance and authorization of the CONUS (Continental U.S.) MARS Director Tom Moore in Ft. Ritchie, Maryland.

Edward Addy KEØEG, owner of NW Antenna & Communications in Minneapolis, first conceived of the Desert Voices project last October. By the first week in November, people and resources were coming together so quickly that, according to MARS Digital Communication Coordinator Paul Ramey WGØG, one of the biggest challenges was to make sure that everything was being put together in an orderly way. "All we had to do was say, 'We need it,' and someone would come forward with it."

Although thousands of hours went into the acquisition of equipment and renovation of the site—painting, rewiring, construction of operating positions, and installation of the multiuser LAN computer system—Ramey WGØG says it "came together overnight." Addy KEØEG, who designed the antenna system and communications center, gave much of himself, both financially and personally, Ramey said. When Addy presented his plans to other businesses, the donations quickly started rolling in.

The U.S. Bureau of Mines provided the lease for the 34-acre site and the buildings. Unused for 20 years, it took many hours and materials to get the main building in shape. Local businesses freely donated "all the right stuff" to repair, repaint, rewire, and upgrade the old building's heating and electrical systems. Other businesses provided electrical power, telephone service and FAX time, carpentry skills, furniture, graphic and printing services, video documentation and training materials, and office equipment.

Well-Equipped

Regional Sales Manager Mike Forsyth of Kenwood U.S.A., who first let *73 Magazine* know about the Desert Voices project, says that Kenwood has supported the project with thousands of dollars worth of radio equipment. "We couldn't have gotten on the air so quickly without their help," said R. Hugh Beebe WL7AIT, MARS Liaison for command and control. Other contributors include: AEA Electronics, four TNCs; D.F. Countryman of St. Paul, RF patch panel material, connectors, and RG-8/U coaxial cable; and A&C Metals of Blaine, Minnesota, heavy duty antenna mast material.

From outside the facility, you can see two full-size rhombic antennas for transmitting phone patches, two 4-element 20m monobanders and one 6-element monobander for 15m HF operation, a 40m dipole, and VHF antennas. Northeastern States Power Company provided the materials and crew to install the 547′ x 250′ rhombics on eight 105′ tall power poles. They also donated 8000′ of #2 solid copper wire. Without these antennas, Desert Voices would not be able to achieve reliable communications with the Middle East some 6500 miles away. Delmar Land Surveyors surveyed the exact location to make sure the antennas were correctly aligned.

St. Paul Tower constructed a 120′ tower between the two rhombics. Later, they will install six antennas for communications with other MARS stations throughout the U.S. Mirage/KLM has donated three special beam antennas for this tower, and Telex Hy-Gain is providing a rotator. Technical Materials Corp. of Mamaroneck, New York, provided low-loss, high power, precision antenna balun transformers and terminators for the rhombics.

The project actually comprises three complete radio station systems at the Desert Voices site. By the third week in January, the second station will be complete and the phone-patch capacity will rise to 1000 per day. It will be one of the four largest MARS relay stations in the world.

A Priceless Service

Desert Voices radio station AAR5NSF went on the air December 13, 1990. Within a month, it had handled over 600 phone patches and 400 packet communications. It is directly interfaced to the gateway MARS stations on the East Coast and serves as an alternate gateway, or relay, station for Army MARS. Thanks to volunteers from the Civil Air Patrol, the military (both active and reserves, including the Minnesota National Guard), law enforcement agency dispatchers, and—of course!—the amateur radio community, the Desert Voices station operates around the clock, seven days a week. There are four radio operators on duty at all times.

Ramey WGØG says that about 150 hams have assisted the project in some way, and Addy KEØEG confirms that 93 hams are currently on active duty at the station. "They're doing a tremendous job," Addy says. And Ramey: "It didn't take any arm-twisting." Most importantly, says Ramey, the ham community's speedy response to the call for help proves that hams are "a reliable resource for their country." They have freely given of their time, knowledge, and skills. Some have donated money or equipment. At Desert Voices, radio operating skills and techniques, learned in fun, are put to serious, disciplined use to provide a service that "you can't put a price on," says Addy. How much is it worth to a mother, father, spouse, or friend to get in touch with a loved one who is in an uncertain and potentially dangerous situation? R. Hugh WL7AIT adds that Desert Voices is not representing any political opinions about the situation in the Middle East. "We're providing a human service."

Ready for the Future

All the staff interviewed at Desert Voices agreed that there are few activities more satisfying than using your abilities to benefit others. The amateur radio operators at Desert Voices are gaining that unique fulfillment you get from knowing that you have ability, and are able to use it skillfully.

Addy KEØEG reminds us that one of the basic purposes of maintaining the Amateur Radio Service is "to provide a pool of trained radio operators" for the country for emergency communications. Entrusted with valuable radio spectrum for their personal use, there is nonetheless the expectation that hams will be useful when the need arises. Ramey says the response shows that hams are willing and eager to "give something back" to the country that supports the continued existence of their hobby.

In his letter to Kenwood, Hugh WL7AIT wrote that upon return of the forces from Saudi Arabia, "we envision the equipment at the Minnesota site to be returned for further humanitarian support missions that may be encountered in the future." At that time, the site itself will be returned to the Minnesota National Guard; however, MARS personnel and members will be ready to step in to provide emergency communications whenever it again becomes necessary. Hopefully, there will always be plenty of hams who, for the sheer love of radio communication, will be ready to do their part, too.

Author's Note: Let us know when you, or someone you know, is involved in activities helpful to the country, community, and world. Sure, you'd rather stick by your rig in

Continued on page 77

Elementary Mode S

Satellite fun on 2.4 GHz–the easy way!

by Ed Krome KA9LNV

The launch of the Microsats has provided some really interesting opportunities for experimentation in both operating modes and frequencies. The digital modes include PSK (Phased Shift Keying) from 1200 baud (PacSAT and LuSAT) to 9600 baud (UoSAT 14), 1200 baud packet AFSK (Audio Frequency Shift Keying) (DOVE), digitized pictures (WeberSAT), and a digi-talker (DOVE).

If this isn't enough to make any experimenter think he's in heaven, there are also three different frequency schemes in use. The most common frequency combination is Mode J, with a 2 meter (145 MHz) uplink (Earth to satellite) and a 70cm (435 MHz) downlink (satellite to Earth). The active digital repeater/mailbox satellites, PacSAT, LuSAT and UoSAT, use this scheme. DOVE's main transmissions are on the 2 meter band, as this satellite was designed for easy reception in classrooms using a minimal ground station.

Two of the satellites (PacSAT and DOVE) also incorporate a third downlink frequency as a beacon: Mode S, which operates in the 13cm band. Way up there. Yeah, 2400 MHz. What, you don't have any 13cm equipment? That's not hard to believe, since that is the lowest band for which there is not a single piece of integrated commercial equipment available. No plug-in modules for the Yaesu FT-736, either. But the band is there, part of our amateur allocation, and alive and well. OSCAR-13 has a full transponder for Mode S, allowing QSOs with a 70cm uplink. And various areas of the country have terrestrial activity in a different segment (2304 MHz) of the band. There is even EME (Earth-Moon-Earth) activity up there.

While this is more of a "how to" than a pure construction article describing 13cm receiving equipment, I have included "benefit of experience" construction techniques on some commercially available kits. And, for the more adventurous types, I have included construction information for a 13cm antenna.

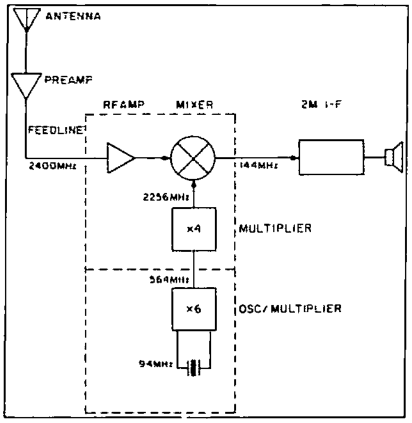

Figure 1. Basic 2400 MHz receiving converter.

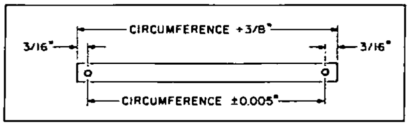

Figure 2. Loop yagi element dimensions.

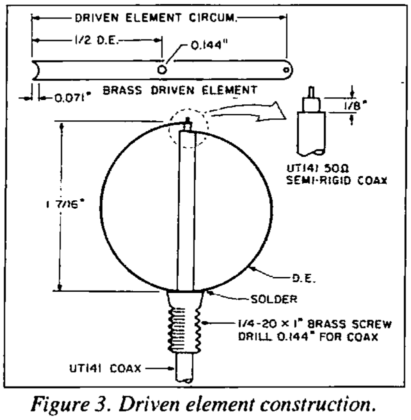

Figure 3. Driven element construction.

Mode S and How to Get There

Becoming active on the downlink end of Mode S has the same requirements as any other band: an antenna to catch the signal and a receiver to hear it. On the higher VHF and UHF bands, the receiver part of this recipe is usually handled with a two-part approach. A converter changes the VHF or UHF signals to something more manageable, which is then fed to an HF or VHF receiver. In this manner, one good HF or VHF receiver (or transceiver) can be used for many bands by merely adding the appropriate converter. In my own station, my integrated receivers and transmitters are all HF stuff, good only to 30 MHz. And they contain lots of vacuum tubes, too. Converters do everything beyond that, and sometimes converters get plugged into converters. This works fine.

Coming up with a receiving converter for 13cm presents some interesting problems. A basic 13cm converter, like any other superheterodyne device, consists of three parts: an RF amplifier chain, a local oscillator, and a mixer. Because antennas and converters are usually separated by some distance and coupled by some sort of (lossy) feedline, standard practice is to divide the RF amplifier section of the converter into two separate parts: the converter proper, and a second part of the RF amplifier chain, called a preamplifier, mounted as close as possible to the antenna. (See Figure 1.) While preamps can't compensate for an inadequate antenna, they can do wonders for high loss feedlines. And they get better as the frequencies get higher. A very low noise preamplifier mounted close to the antenna will amplify the desired signal as well as the background noise. At frequencies above 432 MHz, background noise from the sun, sky, etc. is quite low, so you amplify a lot of signal and not much noise. The cable connecting the preamp to the rest of the converter merely attenuates the desired signal, but it attenuates any accompanying noise with it as well.

Within limits, the all-important signal-to-noise ratio is mostly preserved, even from a long run of pretty lousy cable. If you mounted that same very low-noise preamp after a run of cable, the preamp would be amplifying a signal attenuated by the loss of the cable. The signal-to-noise ratio would be lower, and once signal is lost, it's gone forever. It doesn't matter how much gain you add, you just amplify noise. And any cable becomes lossier as the frequency goes up. For example, a 100-foot run of Belden 9913 may have only 1.6 dB loss at 144 MHz, but it has over 10 dB loss at 2400 MHz. Extremely good coax can minimize this, but have you priced ⅞" Andrews Heliax hardline and connectors

Sources of Supply

Down East Microwave (Bill Olson W3HQT)	SSB Electronic USA (K3MKZ)
Box 2310, RR1	124 Cherrywood Drive
Troy ME 04987	Mountaintop PA 18707
(207) 948-3741	(717) 868-5643

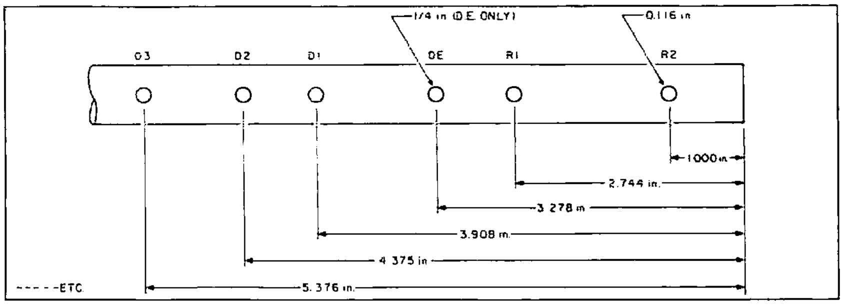

Figure 4. 13cm loop yagi boom drilling.

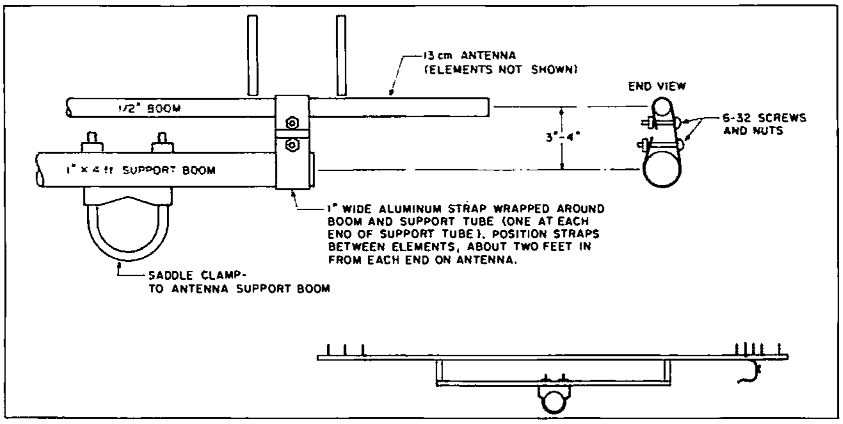

Figure 5. 13cm antenna and support assembly.

lately? Preamps are much cheaper.

Current technology in low-noise, high performance preamps uses GaAsFET (Gallium Arsenide Field Effect Transistors) devices. SSB Electronic and Down East Microwave manufacture good preamps. Later on in this article I'll detail a home-constructed device that offers good performance at a reasonable cost.

Since we have been working from the back end forward, the last part of the Mode S equation is the antenna.

Among EME types, the parabolic dish is the only way to go. The rest of us have really only two readily reproducible designs to work with, the loop yagi and the helix.

The Yagi-Uda (usually called simply "yagi") type of antenna, with many near half-wavelength parasitic elements, is the most common design at VHF and lower frequencies. Element lengths get unmanageably critical at 23cm and above, so yagis have mostly been replaced by the loop yagi. Loop yagis were originally developed by Mike Walters G3JVL and replace the yagi's straight elements with near full-wave loops made from strips of aluminum. Construction tolerances are still tight, but manageable. One of the best parts of a loop yagi is the driven element feed system. No balun is required, just a solder-it-together brass loop element on a piece of feedline. And it is at DC ground, which provides static electricity protection for your equipment. You can buy loop yagis in kits or ready-made (from Down East Microwave), or you can "roll your own."

Available Hardware

A review of available receiving equipment for Mode S shows both kits and built-up converters and preamps available from SSB Electronics and Down East Microwave. Down East Microwave also has antennas and carries the SHF Systems line of "no-tune" converter kits and built-up units.

Homestyle—Almost

Now let's look at what it takes to get a real working station going on Mode S, home-construction style. The problem with 13cm limiting equipment construction to a (very) few hard-core types can be summed up in one word: alignment. Once you build something, you have to get it working. Then you have to optimize it. To align a piece of receiving gear, you have to have something for it to listen to. But on 2400 MHz it is about as difficult to build a signal source as it is to build the converter it was intended to align. Remember "Catch 22"? Tricky, eh?

Recently, equipment has become available that is changing all that. Traditionally, converters and receiver front ends have consisted of myriads of sharply tuned circuits with trimmer capacitors and lots of interactive adjustments. Designs of this type are hard enough to get working at HF frequencies, and they get progressively worse as you go higher. The best alignment (and troubleshooting) device, the spectrum analyzer, is not a household appliance. In their quest for compact, reproducible UHF ham gear, several amateurs, among them Richard Campbell KK7B and Jim Davey WA8NLC, have developed a series of "no-tune" transverters. Honest. Only one possible adjustment in an entire transverter and that is in the local oscillator. That doesn't sound too bad, does it?

These no-tune transverters are based on two developments. One, the MMIC, is recent. The second, bandpass filtering using broadband printed hairpin filters, has been around awhile. MMIC's or Monolithic Microwave Integrated Circuits are truly incredible devices. Tiny and inexpensive, they are broadband gain blocks with fixed input and output characteristics. They don't oscillate or require any critical external components. They are typically 50 ohms in and out with low VSWR. With these devices, gain is so easy to get that it is no longer necessary to worry about whether or not you get gain from more ticklish circuits, such as frequency multipliers, or to worry about filter loss. Not enough signal at some stage? Add another MMIC. No problem.

With gain no longer a problem, the designers could do things like develop passive, no-tune diode frequency multipliers. Drive a diode into generating harmonics and select the one you want with filters. Anyone who has ever built VHF gear knows that the worst part of the whole mess is getting active frequency multipliers to work right. Ugh.

Easy, broadband gain also worked well

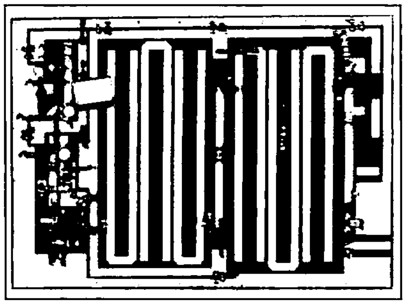

Photo A. 564 MHz local oscillator (Down East Microwave SHF-LO).

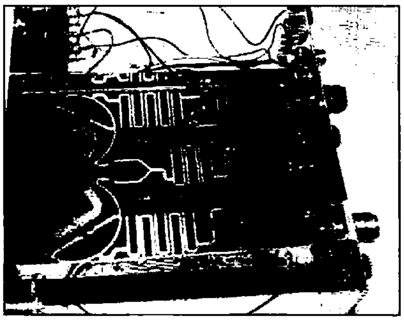

Photo B. Mode S transverter board (Down East Microwave SHF-2301).

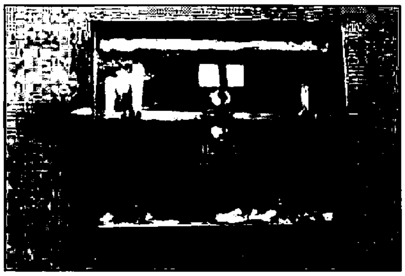

Photo C. 13cm "no-tune" preamp (WB5LUA design—available from Down East Microwave).

with the design of printed hairpin bandpass filters. Filters were designed with manufacturing tolerances taken into consideration to provide broad, flat passbands and steep slopes. Manufacturing irregularities which were once fatal now have little effect. These filters also have no tuning required, or even possible.

The entire no-tune transverter is available in two forms as kits from Down East Microwave. One version is a dedicated S-band receive converter (the SHF-2401K). The second is a transverter, which has the same receiver and also a 10 mW transmit section (SHF-2304). If you are going to build something like this anyway, get the transverter and help get more amateur activity on 13cm. Even barefoot, 10mW is adequate for local contacts. You can always add transmit power later. Remember, as amateur radio operators, we either use those frequencies or we may lose them. The commercial guys are always hungry for spectrum, and ours looks tasty. Both units use a 2 meter IF (Intermediate Frequency). *[Ed. Note: See the February 91 issue of 73 for a review of these kits.]*

Construction Hints

As the photos show, construction of these devices is straightforward. Build the local oscillator first. You must follow the recommended layout and use good construction techniques. Keep the leads short and solder the joints well. Be sure to ground the one pad that is noted as requiring through-the-board grounding. Also, pay attention to the orientation of the transistors and MMICs. The Avantek MSA-04 series has the dot on the output, while the MCL MAR series has the dot on the input. The total tune-up requirements are to tweak a 10 pF trimmer for maximum LO output. Photo A shows a complete and functioning local oscillator.

A common complaint deals with the difficulty of installing chip capacitors. To do this right, you need a small (15 watt) soldering iron with a small tip, tweezers, a toothpick, and a magnifying glass. The last item is a suggestion that I learned through experience. Since I passed a certain magic age, I find I can't see far away with my glasses off, and I can't see close up with them on. So I bought a set of Sears headband-mounted binocular magnifiers. These are only 2½ power, but they're perfect for getting parts in the right place.

To mount the chip caps (now that you can see them), first lightly tin one circuit board pad. Don't tin both or the chip may not sit flat on the board. Then place the chip cap where you want it with the tweezers. Hold it in place with the toothpick and remove the tweezers. Touch the iron to the pre-tinned circuit board trace. Flow the solder onto the end of the cap. Then solder the other end of the cap. Resolder the first end if needed to insure a good connection.

Construction of the converter board itself is probably even easier than building the LO (Local Oscillator). The hard part, at least on the early boards, is that you must use thin brass foil to connect the MMIC ground leads and several pads to the ground plane side of the circuit board. I found that the best way to ground the MMICs is to cut pieces of brass foil about ¼" long and as wide as the MMIC ground pads, then make a 90 degree bend back about 3/32" from one end. Slip the long end through the board hole from the circuit side (use the magnifiers to make absolutely sure that there are no shorts to the input or output pads), then hold it in place by putting an awl into the hole. This will form the brass to the hole at the top, allowing you to insert the MMIC down into the hole in the board, where it belongs.

While holding the foil in the hole with the

2304/2401 MHz Loop Yagi

Element	Spacing (Original 2304 MHz) (inches)	(cm)	Circumference (Original 2304 MHz) (inches)	Circumference (Scaled to 2350 MHz) (inches)
R2	1.000	2.54	5.480	5.373
R1	2.744	6.97	5.480	5.373
DE	3.278	8.33	5.125	5.025
D1	3.908	9.93	4.676	4.584
D2	4.375	11.11	4.676	4.584
D3	5.376	13.66	4.676	4.584
D4	6.378	16.20	4.676	4.584
D5	7.081	17.99	4.676	4.584
D6	8.380	21.29	4.676	4.584
D7	10.383	26.37	4.676	4.584
D8	12.385	31.46	4.676	4.584
D9	14.388	36.55	4.676	4.584
D10	16.390	41.63	4.676	4.584
D11	18.393	46.72	4.676	4.584
D12	20.395	51.80	4.534	4.445
D13	22.398	56.89	4.534	4.445
D14	24.400	61.98	4.534	4.445
D15	26.403	67.06	4.534	4.445
D16	28.405	72.15	4.534	4.445
D17	30.408	77.24	4.534	4.445
D18	32.410	82.32	4.392	4.306
D19	34.413	87.41	4.392	4.306
D20	36.415	92.49	4.392	4.306
D21	38.418	97.58	4.392	4.306
D22	40.420	102.67	4.392	4.306
D23	42.423	107.75	4.392	4.306
D24	44.425	112.84	4.335	4.250
D25	46.428	117.93	4.335	4.250
D26	48.430	123.01	4.335	4.250
D27	50.433	128.10	4.335	4.250
D28	52.435	133.18	4.335	4.250
D29	54.438	138.27	4.335	4.250
D30	56.440	143.36	4.335	4.250
D31	58.443	148.45	4.335	4.250
D32	60.445	153.53	4.335	4.250
D33	62.448	158.62	4.335	4.250
D34	64.450	163.70	4.335	4.250
D35	66.453	168.79	4.335	4.250
D36	68.455	173.88	4.279	4.195
D37	70.458	178.96	4.279	4.195
D38	72.460	184.05	4.279	4.195
D39	74.463	189.14	4.279	4.195
D40	76.465	194.22	4.279	4.195
D41	78.468	199.31	4.279	4.195
D42	80.470	204.39	4.279	4.195
D43	82.473	209.48	4.229	4.146
D44	84.475	214.57	4.229	4.146
D45	86.478	219.65	4.229	4.146
D46	88.480	224.74	4.229	4.146
D47	90.483	229.83	4.229	4.146
D48	92.485	234.91	4.229	4.146
D49	94.488	240.00	4.229	4.146

Boom: 8' length of ½" diameter aluminum tubing (do not use anodized tubing).
Elements: All elements are made from aluminum strips 0.25" wide by 0.032" thick.
Circumference: Distance between centers of 0.116 holes drilled in each element. Tolerance ±0.005". Each element is to be made approximately ⅜" longer than the specified circumference dimension to allow approximately 3/16" overlap between the ends of the element.

Table 1. Scaled from W1JR 13cm 52-element design.

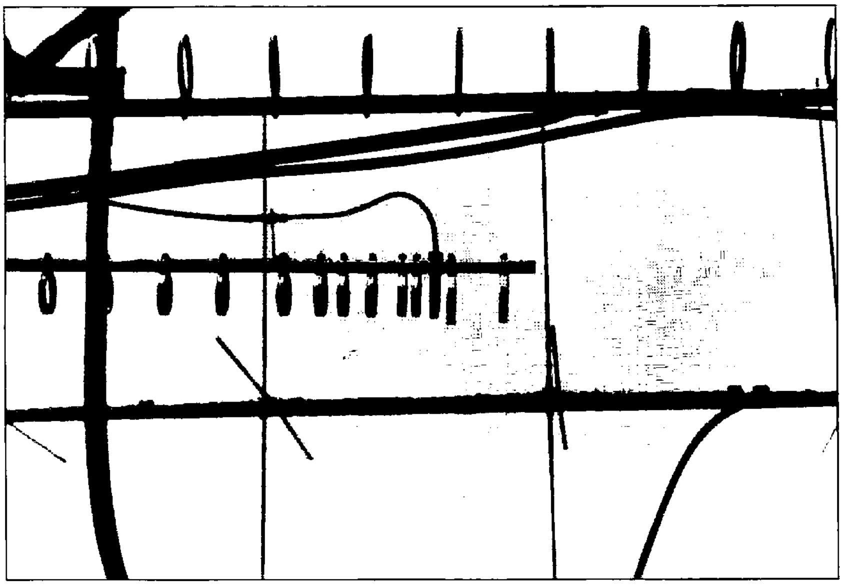

Photo D. 13cm loop yagi, mounted upside down, showing driven element detail and two reflectors. A 23cm loop yagi is on top, with a 2m cross yagi behind it. The T-shaped structure on the left is the power divider with hardline phasing lines for two 19 element yagis on 70cm.

awl, use your fingernail to spread the foil away from the hole and lock it into place on both sides of the board. A little experimenting will make it easy. Before you solder, inspect it carefully for shorts. Solder the top side lightly so the MMIC will sit flat on the board. Sometimes it is helpful to solder the pad, then clean it off with a piece of Solder-Wick™ desoldering braid. The resulting pad will now be well-tinned and easy to solder quickly.

Several pads on the converter board must be connected to the foil side of the board. One way to do this is to make slots in the board by carefully rocking an X-acto® knife blade through the board. The Teflon™ board material cuts easily. Then thread a strip of the brass foil through the slot, bend it flat on both surfaces, and solder it in place.

A suggested construction technique is to solder the MMIC bias resistors to the centers of the hairpin filter elements where possible. This improves stability. Photo B shows the routing on a complete transverter board.

Mounting the HP-2822 diode packs can be interesting. They are as small as chip capacitors, have three leads, and are surface mount devices. The same technique that works on the chip caps works here also. Tin one pad, position the diode pack with tweezers and a toothpick, then tack one lead. Then solder everything.

The initial results using this converter absolutely amazed me—it worked the first time I fired it up. I heard the S-band beacon on DOVE the first time I tried. Not bad.

A suggestion on improving the versatility of the converter: Wire it to work both commonly-used segments of the band. Remember about "use it or lose it"? The satellite subband is at 2400 MHz. Use of a 94.00 MHz crystal in the LO puts the Microsat S-band beacons (2401.221 for DOVE) at an IF of 145.221. A 90.00 MHz crystal will put the 2304 weak signal frequency at 144 MHz. Wire a small DPDT relay to the board to switch between the two crystals. Keep the leads short.

Preamp Construction

The next segment of the Mode S rig is the preamp. Fortunately, Al Ward WB5LUA has developed a series of no-tune preamps for the UHF bands, all the way to 10 GHz. These were detailed in *QST*, May 1989. Construction is easy, but for best results you must follow Ward's instructions. The 13cm version uses an ATF 10135 GaAsFET, and offers a less than 1 dB noise figure. While all the preamps were shown with grounded sources (which require separate gate bias supplies), the 13cm unit was also shown in a self-biased version. This means that there is no negative gate bias supply to fuss with, but you must ensure that the source leads are properly RF grounded.

Proper RF grounding of the two source leads is done by connecting them to very low inductance disk capacitors. The RF energy thinks the capacitors don't exist and that the source leads are really grounded, but there is no DC ground. So, self-biasing is accomplished by standing the sources above DC ground with a resistor.

Never content to leave well enough alone, I built two preamps and used slightly different construction techniques on each. On one unit, I drilled holes to fit the disk capacitors through the circuit board as instructed in the article, then grounded the capacitors underneath.

On the second I used a different technique. First, use the X-acto knife to make slots in the circuit board at the inside edges of the small rectangular pads on either side of the GaAsFET. Then thread ¼" wide strips of very thin brass foil through the slots. Flatten the foil to the board and solder it to both sides. Tin one side of a disk capacitor. Then position one disk capacitor properly (with the tinned side down), and heat the brass strip from the underside with a 40 watt iron. When the heat transfers through the foil, it will melt the solder and stick the capacitor in place. It is very easy to break a disk cap by excess pressure, so be careful. After mounting the disk caps, check them with an ohmmeter to insure against shorts to ground.

The circuit board is very flexible and bends easily, so make it more rigid before mounting the rather delicate chip devices. One way to do this is to bend or piece a ¾" wide by 0.016" thick hobby brass strip all the way around the circuit board. Leave ⅛" overlapping the bottom side of the board. Mount the connectors and feed-through on the strip. Then solder connectors and strip to the circuit board. Solder the board ground plane to the strip all around. Mount the chip components, zener diode and GaAsFET last. Doing the heavy soldering between the walls and board first not only physically protects the components from fractures induced by bent boards, it also keeps you from frying the chip components.

Kits are available from Down East Microwave. I built two of these, one with right-angle-mount N-connectors and one with end-launch SMA connectors, just like Ward suggested. Both work, but the SMA version (which has the brass foil source grounding straps) works better. This unit is shown in Photo C.

The Antenna

Last but not least is the loop yagi. The design I used was based on that presented by Joe Reisert W1JR at the first annual 1296/2304 Conference (19–22 September, 1985, in Estes Park, Colorado). His design was for 2304 MHz. Since I wanted to use the antenna on both 2304 and 2401, I did the unpardonable and scaled W1JR's element lengths to 2350 MHz. I did not change the element spacing. This antenna has 52 elements and fits on an 8' section of ½" diameter aluminum tubing.

One method of building this antenna is to get a sheet metal shop to shear a bunch of ¼" wide strips about 2' long from a sheet of 0.032" thick aluminum. Do not use anodized aluminum for the elements or the boom. Element lengths and spacing are itemized in Table 1. Scribe off the required lengths on the strips with a steel scribe point set of dividers. Adjust the dividers with a dial caliper and lay them off. Recneck each dimension. Tolerances are ±0.005", so be careful. Remember to leave 3/16" between the center of each hole mark and the end of each strip and ⅜" between adjacent holes on a strip. These will be cut apart later, as it is easier to handle a whole strip. After you scribe a length, mark the element number or group on it with a waterproof marker. Then, with a magnifying glass, center punch each mark accurately. Drill each hole 0.116 (#32 drill) in diameter. Drill them one hole at a time; stacking strips is a sure way to goof. Finally, cut the element strips apart.

Preform each element loop by bending it around a form. A piece of ¾" PVC pipe works fine.

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To mark the element locations on the boom, it seems that millimeters are easier to use than inches, so I converted W1JR's dimensions. It's hard to find a tape measure that reads out in decimal inches! Lay a tape along the boom and mark each location. Dimensions are from the end of the boom. This prevents cumulative errors.

Drilling the boom squarely can be challenging. Eyeballing doesn't work. Use a "universal drill guide" with a V-notch designed to drill holes in the center of a pipe.

Before you start drilling, you must devise a method of preventing boom rotation while drilling, thereby keeping all the drilled holes in line. You must also support the boom high enough off the bench so that the drill guide can slide. One way to do this is to first drill a hole through the boom large enough to clear a 1½" long No. 4 or 6 wood screw. Run the screw into the bench only about ¼". The boom will now be free to move up and down as the drill guide is moved, but will be rotationally fixed. Two screws in different locations may be required if your drill guide has a large base and you can't get all the holes without hitting the screw. Slide the drill guide along the bench with the boom in the V-notch and drill each 0.116" hole. Remember to drill the driven element hole ¼" in diameter.

When assembling the elements to the boom, use 4-40 x ¾" stainless screws, nuts and lockwashers. Put the lockwasher between the nut and the boom, not under the element. Coat the ends of each element with a corrosion inhibitor such as No-Al-Ox™. Weather turns aluminum into aluminum oxide, which is a dandy insulator. No-Al-Ox is available from your local electrical supply house and well worth the nominal cost. Assemble the elements with the overlaps all facing the same direction.

For the driven element, drill a 0.144" (#27 drill) hole through a ¼" brass flat head bolt. Also drill the center of the brass strip driven element to 0.144." You must assemble all the parts (element, bolt, nut, boom, etc.) on the UT141 hardline before you solder things together. Use hobby (low-temperature) silver solder and flux for all outdoor connections as it does not deteriorate from weather like regular rosin core solder. A note: Go easy on the heat on the hardline. If you overheat it, it can swell and rupture. Then you start over. I did.

The finished product, or at least the driven element end, is shown in Photo D amidst a variety of other antenna goodies. Once again, complete antennas and antenna kits are available from Down East Microwave.

The 8' long, ½" diameter boom is flimsy and requires mounting support. The strap mounting method shown is easy and works. A single U-bolt through the support boom mounts the whole thing to the antenna cross boom. See Figure 5.

A note on antenna mounting: Many satellite operators use a nonmetallic cross boom between their antennas. This tends to cut down intermod problems on the harmonically related modes, such as Mode J. If you mount this (or any) antenna on an insulated boom and leave the preamp connected, remember where atmospheric static electricity has to go —down the lead in coax into the shack. Keep the coax disconnected from the equipment and thoroughly grounded in the shack when the antenna is not in use. Never use the antenna when thunderstorms are in the area. We are not talking about a direct lightning strike here either; there is little real protection from a situation like that. I strap-ground the 1296 and 2401 antennas right up on the mounting boom.

Results

Now the big question: Does it work? Since I do not have access to test equipment for this frequency, I took the pragmatic approach—I tried it. The first test was with the loop yagi connected to the no-tune downconverter through three feet of RG-142, 12 feet of RG-213 around the rotors, and 65 feet of 9913. And no preamp, as it wasn't built yet. But I heard the DOVE S-band beacon on the first try.

Since the addition of the WB5LUA no-tune preamp, the DOVE beacon is loud enough to hold the PLL (Phased Lock Loop) on my G3RUH PSK modem, and autotune the attached receiver. DOVE's 100 kHz Doppler shift makes this rather touchy sometimes, as a brief fade can cause the signal to run out of the capture range of the modem. Mostly it holds surprisingly well, considering that the rate of change of frequency fairly screams across the band.

This arrangement also works on the big guy, AO-13, Mode S. Downlink signal strength is marginal for SSB, but quite adequate for CW. However, perseverance has yielded a handful of sideband contacts on that mode, which is quite a thrill. Two hints are useful at this point. First, lots of multiplication (X24) between the LO crystal and the injection frequency offers the potential for large frequency conversion errors. It can be very difficult to predict where to initially find S-band signals. My own set-up has over 50 kHz frequency offset, exclusive of Doppler. The solution is to start by trying to find a loud, strong signal like DOVE and tune all over the place until you find it. Then track the signal, recording the apparent frequency and time and compare TCA (Time of Closest Approach, where the Doppler correction should be zero) to the published actual beacon frequency.

Second, the antenna described here is marginal at best for AO-13. The AO-13 13cm beacon is only a watt or so, and at times is 42,000 kilometers away! When you hear a Mode S signal, rock the antenna position to peak it. It is surprising how much difference this can make.

The advent of no-tune preamps and converters has brought Mode S into the realm of the average experimenter. Good construction practices and attention to detail are rewarded by excellent performance on frequencies previously considered almost unattainable. Now, go out and build some gear. See you on Mode S! 73

Contact Ed Krome KA9LNV at 1023 Goldfinch Rd., Columbus IN 47203.

Touch-Tone Activated Scanner

So you won't miss a call!

by Don Moser AA7Y

Inexpensive, wide-frequency coverage scanners have been developed into valuable tools for the amateur radio operator. There are, however, two drawbacks that keep them from reaching their full potential. First, when you're scanning a number of busy repeaters and simplex frequencies, and Bert and Ernie tie up one repeater, your scanner will most likely be stuck there. If someone tries to call you on another frequency, you won't hear the call. Secondly, you (and the rest of your household) will have to listen to Bert and Ernie so you won't miss a call eventually directed to you.

Photo A. The author modified the Motron Auto Kall AK-4 to solve two common problems.

A Logical Solution

A Touch-Tone decoder alone, connected to a scanner, will solve the second problem: you won't have to listen to all the traffic until you're called. But it won't solve the first problem of the scanner getting hung up on a busy channel. Combining the logic of the decoder and the scanner will, however, solve both problems.

What happens when a normal scanner switches to a busy frequency? The squelch circuit detects a carrier and outputs a logic control signal that tells the scanner to stop scanning. To operate as a Touch-Tone activated scanner, I've opened the logic control line coming from the squelch circuit and inserted a logic signal from the first decoded digit of an Auto-Kall AK-4 Touch-Tone decoder. The scanner won't stop unless it receives the first digit of your code.

If the scanner is programmed to scan 10 frequencies, and it's scanning at the rate of 10 channels per second, the calling station must hold down the first digit of the code for at least one second. This gives the scanner enough time to make one complete cycle through all the frequencies. Once the first digit is decoded, a timer is set that stops the scanner for about 10 seconds, allowing time for the decoder to receive the rest of the code. If the right code sequence is not received within 10 seconds, the scanner resumes scanning. If the correct code is received, another timer is triggered that both turns on your speaker and keeps the scanner tuned to the calling frequency. The calling station identifies and tells you which frequency he's calling on.

I've been using this system for several years now, and it's been a real life-saver. We have four speakers connected to the scanner/decoder and placed at strategic places throughout the house and shop. My wife can always get through on simplex when she's doing errands around town. Friends from various parts of the state can use different repeaters to reach me. Early one Sunday morning, when the phone had been accidentally left off the hook, my brother-in-law was able to wake us up by calling on 2 meters; there had been a serious family medical emergency.

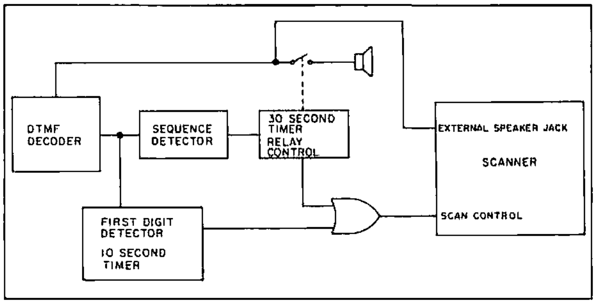

Figure 1. System block diagram.

Scanner Modifications

I implemented this scanning system using the Radio Shack PRO-57 scanner and the MoTron Auto Kall AK-4C DTMF decoder. You can use almost any scanner and DTMF decoder for this project. The PRO-57 is currently Radio Shack's least expensive scanner. Most scanners use similar receiver and scanning circuits. The PRO-57 uses the MC-3361 FM receiver IC. Pin 13 is the scan control output. When it's low, the scan function is enabled. When a signal is present, it goes high and scanning stops.

If you use a different scanner, check the schematic for the line that goes from the receive IC to the scanning section. If you check this line with a logic probe, you should see it changing states when you turn the squelch control on and off. Normally, when the receiver is unsquelched, it tells the scanning control to stop scanning. Since the scanner needs to be stopped with a DTMF signal instead of a carrier, this control line is broken and the input to the scan control is diverted to the output of the DTMF decoder. The line is broken after it goes to the mute circuit on the power amplifier.

Adding Scan-Control and External Speaker Jacks

Two mini-phono jacks (3.5mm) were added to the scanner. One is used to connect the first digit detect circuit in the DTMF decoder to the scan control in the scanner. The

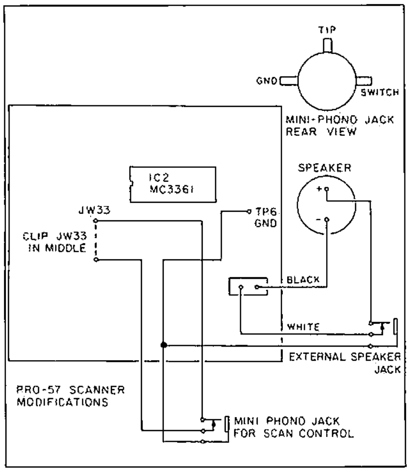

Figure 2. PRO-57 scanner modifications.

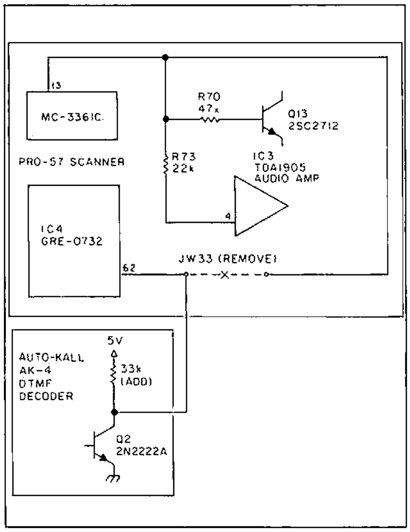

Figure 3. Scan control modifications combine the logic of both the decoder and the scanner.

other is used to add an external speaker jack to the scanner. This provides a way to feed audio to the decoder and to control the speaker line with the decoder. To add the mini-phono jacks, drill two ¼" holes on the side of the chassis, just below the speaker.

Wiring the Scan Control Jack

You don't have to remove the PRO-57's circuit boards. You do have to use anti-static precautions. Be sure to discharge any static electricity on your body by touching a ground before working on the circuit board.

There is a short jumper wire about ½" long in the center of the main board, labeled JW33. One side of JW33 goes to the squelch control, pin 13 of IC2, R73 and R70 (surface mounted on bottom of board). The other side of JW33 goes to IC4 pin 62. Clip this jumper in the middle and raise each side off the board.

Solder wires about 5" long to each side of the cut jumper. Solder the wire that goes to IC4 (the side closest of C110) to the "tip" connection on the scan control mini-phono jack. Solder the other wire (nearest D14) to the switch section of the jack. Connecting the scan control through the switch section will cause the scanner to operate normally when the decoder is unplugged. Connect a wire from the ground lugs of both the scan control and speakers jacks to TP6, the PCB ground.

Wiring the External Speaker Jack

Unsolder the white wire going to the speaker's positive side. Wire this to the "tip" lug on the external speaker jack. Wire the switch lug to the positive lug of the speaker with a short piece of wire.

Decoder Modification

The Auto-Kall AK-4 is well-suited for this project because it has two independent timers. You need one timer to stop the scanner for a short time, 5-10 seconds, upon receipt of the first digit. You need a second timer to turn on the speaker relay for about 30 seconds. You can adjust both times with on-board trim pots. The output of each timer is fed into a NOR gate which is again inverted by an open collector transistor (with a pull-up resistor added). This output is then connected to the scan control. When either timer is triggered, the NOR gate will output a logic-low that turns off the transistor. This puts a logic-high on the scan control line and causes the scanner to stop.

The first timer is used to stop the scanner for 5-10 seconds if the first digit of the sequential DTMF code is received. This stops the scanner to allow enough time for the rest of the code to be entered. If the rest of the digits aren't received, it goes back into scan mode on timeout. If the rest of the code is received, the second timer is triggered, activating the on-board relay and turning on the speaker. This timer is adjustable from about 10 to 60 seconds. A red "call" LED is also latched on, to indicate a received call.

The short timer was originally part of a "group-call" circuit. When triggered, an output would set a NOR gate latch. The timer in this circuit is modified to give an output for 5 to 10 seconds by changing C7 to 10 µF. One of the NOR gates in the latch is isolated and used to control the open collector transistor "GC" output for the scan control.

Modification Details

Remove the following parts on the decoder (AK-4) board: R4, 1k; R18, 33k; R32, 1k; C6, 1 µF; C8, 0.1 µF; and C7, 3.3 µF. Replace C8 with a jumper wire. Change C7 to 10 µF. Remove U2 from its socket, bend out pin 4 and place it back in the socket so that it's disconnected. Remove CR12.

Solder a wire from U4, pin 4, to U2, pin 1. A trace coming from pin 4 of U4 goes to a feed-through hole. Use this hole for one end of the wire by scrapping off the solder mask. Solder the other end of the wire to the hole vacated by R18 that went to pin 1 of U2. A second wire goes from the hole of C6 (that went to U6, pin 11) to the hole formerly used by R4 (that connected to U2, pin 2). Solder a 33k ¼-watt resistor (you can use R18, which was removed) from the GC output (next to +IN) to the pad marked +5.

Three jumpers on the board are used to configure the board for various functions. Connect only jumper J3; leave the other two blank.

Program the board as per manufacturer's instructions. Solder a diode from the first digit of your code, in the programming matrix, to the GC PAD. Cathode side goes to GC PAD. This will cause the short timer to be triggered when the first digit is received.

Connect the GC output of the AK-4 decoder board to the mini-phono jack scan-control input. Connect an audio cord from the external speaker jack of the scanner to the audio input of the decoder.

Testing

Start scanning several frequencies. Using a simplex frequency, hold down the first digit

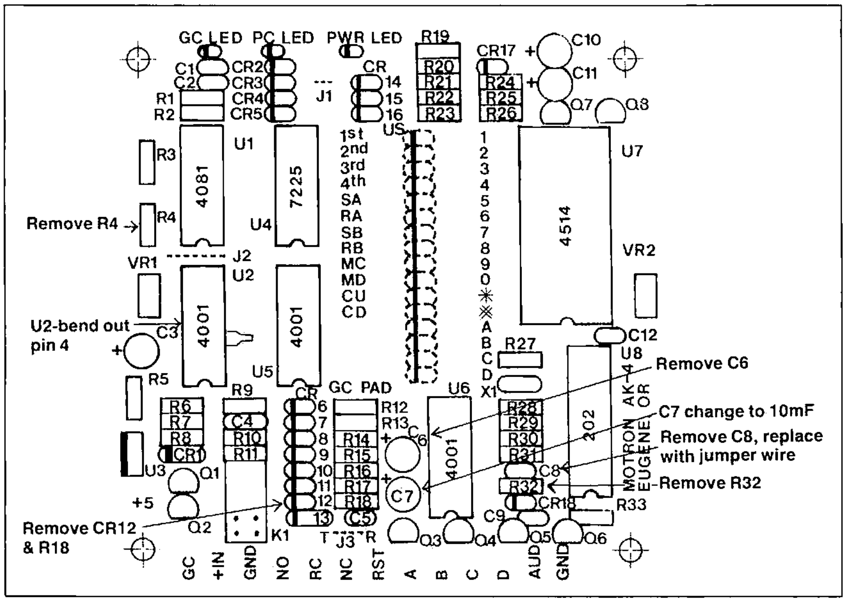

Figure 4. AK-4 modifications (circuit board details).

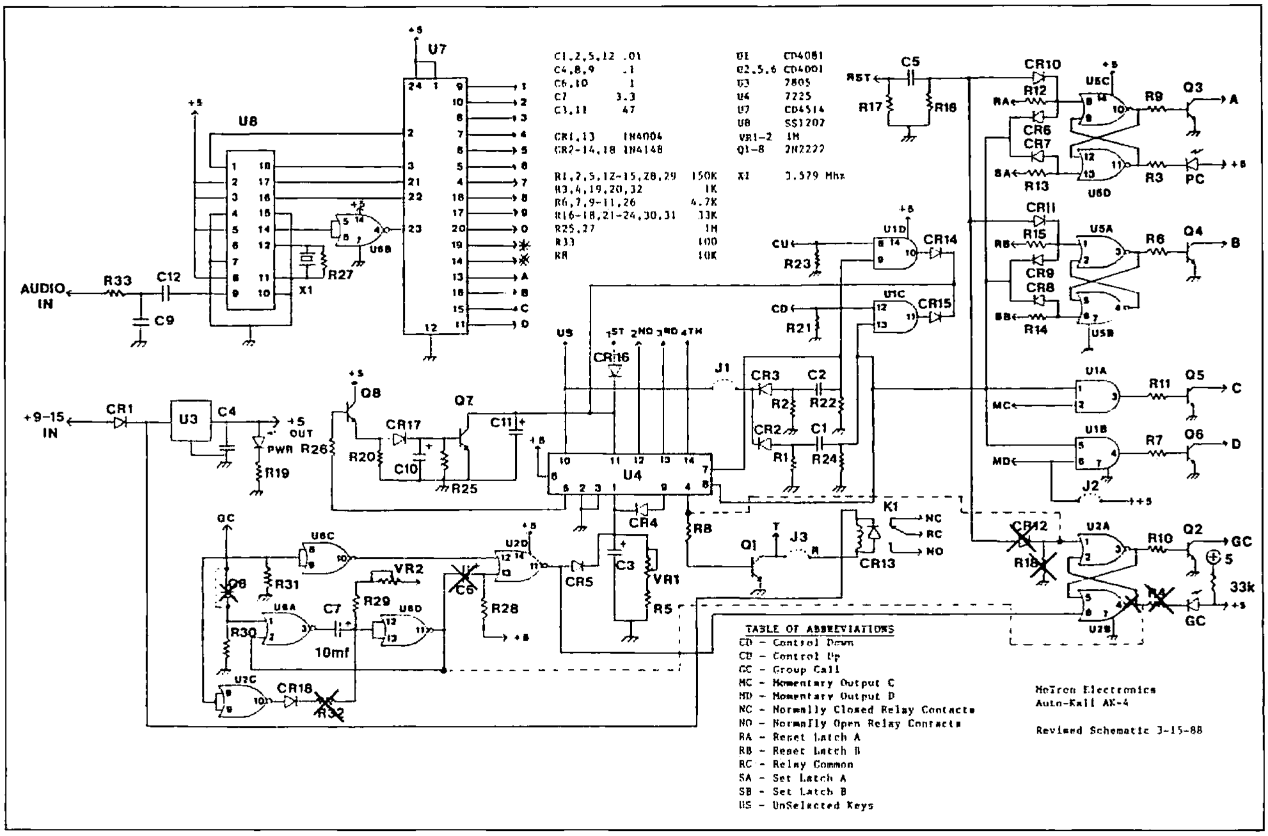

Figure 5. Modified AK-4 schematic diagram.

of your code. When the scanner gets to that frequency, the GC output should go high and cause the scanner to stop scanning. Enter the rest of your code. If all is working well, the relay in the decoder should turn on to open up your speaker or activate an alarm.

The SSI-202 decoder chip used on the AK-4 decodes DTMF signals in about 40 ms. Occasionally, if you start to enter the first digit of your code just as the scanner is crossing the calling frequency, the control signal stops the scanner too late, on the following channel. During testing, this happened only about once every fifty times.

This system will give you a powerful communications tool for either routine or emergency traffic. It will make it possible for you to be reached at any time over a wide geographic area, through the best possible path.

Although you may use other scanners and decoders, you can obtain the AK-4 or AK-4C (complete in a box with a speaker) from MoTron Electronics, 310 Garfield St., Suite 4, Eugene OR 97402. Tel. (503) 687-2118; order line, (800) 338-9058. For $10, MoTron will do the scan modifications on the AK-4W or AK-4C. ■

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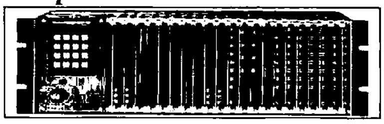
Repeater - Link Controller



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CIRCLE 89 ON READER SERVICE CARD

73 Review

by Joe Holman KA7LDN

The ICOM IC-970H VHF/UHF Multiband All-Mode Transceiver

A great rig for both satellite and local communications.

ICOM America
2380 116th Avenue NE
Bellevue WA 98004
(206) 454-8155
Price Class: $3000

Recently I had the opportunity to use an ICOM IC-970H VHF/UHF (i.e., 2m and 70cm) multiband transceiver. This is a full-featured multi-mode rig designed with the satellite operator in mind. It's also a fine rig for terrestrial contacts both on SSB/CW and FM.

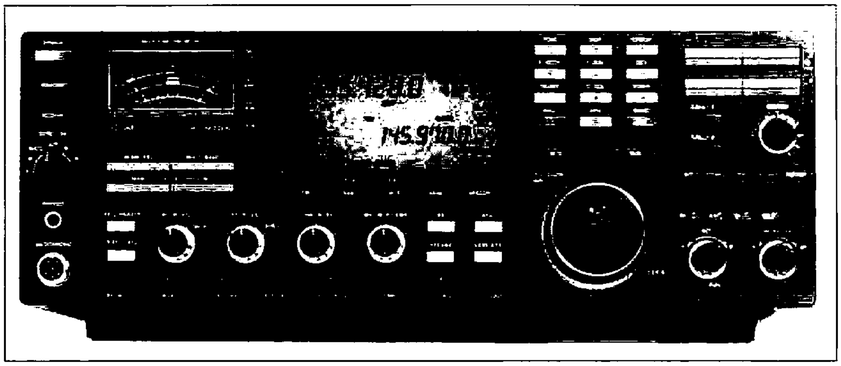

Photo. The ICOM-970 multiband VHF/UHF transceiver.

Dimensions and Front Panel Layout

The IC-970H is a big radio: 16.7" W x 5.9" H x 16.0" D, approximately the same size as ICOM's IC-765 HF radio.

The front panel of the radio supports "bigger-the-better" controls. The tuning knob is 2" in diameter, and the basic control knobs are 0.75" in diameter. In the center of the front panel, there is a 4.5" x 2.5" black-on-yellow LCD display which provides the following information:

- Main and sub mode of operation.
- Main and sub operating frequencies.
- General coverage RX on/off.
- RIT change of frequency (only for main).
- Main and sub VFO (A or B) selection.
- Main and sub memory channels.
- Sub receiver S-meter.
- Tuning pitch indicators.
- Main and sub duplex indicator.
- Scan indicator.
- Tone/squelch/beep indicator.
- Split operation indicator.

Also, the radio has a large S meter, 2.75" x 1.75", that is placed directly to the left of the LCD display.

On the very left side of the radio, you can find the SATELLITE switch which provides the following six tracking configurations (and which proved to be very useful during my satellite experimentation and operation with the radio):

- OFF—Main and sub frequencies do not track.
- N (Normal)—Main and sub frequencies change in same direction.
- R (Reverse)—Main and sub frequencies change in opposite direction.
- SATL—Used for programming uplink and downlink pairs to memory, no tracking takes place.
- SATL-N—Allows selection of uplink/downlink memory channel, tracks in same direction.
- SATL-R—Allows selection of uplink/downlink memory channel, tracks in opposite direction.

I'll discuss more about the SATELLITE switch in the "Satellite Memories" section.

Manual

The manual is 48 pages long. The majority of the manual describes what each of the control functions and connections on the front and rear panels do. The remaining sections of the manual provide general operating procedures for packet and satellite operation, and provide details (with many internal views of the radio and replaceable components) about how to install optional accessories and modify factory set internal controls. I was impressed with the level of detail presented in this manual. It is one of the best that I have seen ICOM produce. See Table 1 for a complete listing of the IC-970H's specifications.

Receiving and Transmitting

During my voice communications, I spent most of my time operating on AO-13. I made QSOs on this satellite for just about three-fourths of the entire pass on two different days. This allowed me to test the IC-970H during various operating conditions, such as when the squint angle of the satellite's antenna was greater than 20 degrees, less than 20 degrees, and on the two major modes used: Mode B (70cm up and 2m down) and Mode J (2m up and 70cm down).

For antennas, I used the KLM 18C (12.0 dBi gain) for 70cm, and an old beat-up Cushcraft 10-element beam (10.5 dBi gain) on 2m. The preamplifiers were the ICOM AG-35 (15 dB gain, NA noise) for 70cm, and the ICOM AG-25 (15 dB gain, NA noise) for 2m, mounted at the antenna feedpoint. For feedline, I used an 80-foot run of Belden 9913 (2.6 dB loss per 100 feet) for 70cm, and a 50-foot run of RG-8/U foam (2.0 dB loss per 100 feet) for 2 meters.

Most of my AO-13 QSOs were made on Modes B and J. While operating on AO-13, I worked the following stations (all contacts were on Mode B, unless otherwise noted): AA6PJ, KC7IT, DD5LQ, ON1LST, PE1HXD, FC1GNV, PA0STE, OE5WHN, SM2SWU, JA9WMS, UA0OB (both B and J), JR2UOE, and VK4KZR (Mode J only). As you can see, I made contacts with many locations around the world.

In addition, I used my IC-275H and IC-475H during these passes to compare the versatility of the IC-970H's uplink and downlink systems.

The first thing that caught my attention was the IC-970H's audio. Its audio is much more robust (better bass) than what my IC-275H or IC-475H produces. Good audio always makes satellite communications more enjoyable.

For receiving, the IC-970H has comparable sensitivity to both the IC-275H and the

IC-475H. Most stations running about 25 watts and up on AO-13's 70cm uplink (for Mode B) were S-5 and above on the IC-970H's 2m downlink receiver. Similarly, stations using 2m on the uplink (for Mode J) and running about 25 watts or more, resulted in downlink signals in the range of S-4 to S-5. Stations using near 75 watts and up were producing S-9+ signals. Please note that your signals may vary due to the gain of your antennas and loss in your transmission line, and the current squint angle of the satellite's antennas. In general, though, the results were very much on a par with other satellite receiver systems that I have used in the past.

For transmitting, the 30 and 35 watts produced by the IC-970's 70cm and 2m transmitters resulted in below average signal levels when compared to many of the other downlink signals on the satellite. To increase my signal, I decided to activate the speech compressor. The speech compressor produced a very noticeable increase in signal strength and improved the basic sound quality. I estimate the gain increase was almost 6 dB (one ICOM S-unit).

1200 MHz Option

The IC-970H comes with 2m and 70cm band units installed from the factory. These two bands are primarily used for Mode B and J satellite communications. In case you want to operate on Mode L (1296 MHz uplink and 70cm downlink), the IC-970H lets you install the UX-97 1200 MHz optional band unit for Mode L use. The UX-97 supports SSB, plus CW and FM, and has 10 watts output power.

Satellite Tracking and Memories

In addition to allowing you to store 99 different frequencies into the per band memory channels, the IC-970H allows you to store 10 uplink/downlink frequencies and mode pairs (transponder uplink and downlink tracking frequencies). I found this feature to be very convenient. I programmed frequencies for AO-13's Mode B into channel 1, AO-13's Mode J into channel 2, and FO-20's Mode J frequencies into channel 3. (To program into a particular channel, the SATELLITE switch must be in the SATL position.) Now when I need to use a particular mode on one of these satellites, I put the SATELLITE switch to the SATL position, enabling the 10 special memory channels; then I select a particular channel with the Memory Channel Switch, and turn the Satellite Switch to the corresponding tracking direction (either N or R position). Tuning with the main dial now changes the main and sub frequencies in either the same direction or inverse direction, accordingly.

How did I compensate for the Doppler shift? When operating in this manner and encountering Doppler shift, just deactivate the MAIN/SUB switch, allowing frequency changes on both the main and sub VFOs at the same time. Change the RX frequency just enough to allow for the Doppler shift. After this tuning, activating the MAIN/SUB switch allows you to continue to change frequencies on both the main and sub VFOs at the same time by using the main dial.

Tracking in this manner, but not using a particular stored memory channel, is also available with the two remaining positions of the SATELLITE switch.

Scanning

The main and sub scanning features are not necessarily needed for satellite operations, but they are good for local activity. The feature I liked best is that both the main and sub bands can be selected for scanning at the same time (by using the Main and Sub Scan Switches) in addition to the more common individual band scan feature found on most receivers.

Both the main and subbands can have 99 memory channels programmed, and they each have the capability to have a selected portion of their bandwidth scanned (this feature uses the P1 and P2 memory channels). The IC-970H can perform four types of scanning: *programmed scan*, which scans between two programmed scan edges; *memory scan*, which repeatedly scans all memory channels in the selected band; *mode-select memory scan*, which repeatedly scans memory channels with the same selected operating mode in a particular band; and *multiband memory scan*, which allows scanning with an optional installed band.

Satellite Packet Operation

In addition to using the IC-970H for voice communications, I used the radio to copy telemetry from FO-20, DOVE, and Pacsat. Currently, I am using a PAC-COMM Tiny-2 and PSK-1 to decode the BPSK and AFSK telemetry signals from these birds with my IC-275H and IC-475H radios. To copy the telemetry using the IC-970H, I just inserted a microphone connector and connected the audio input and ground of the PSK-1 or Tiny-2 (depending upon which bird I was copying from) to the microphone connector. This provided the bare minimum connections required to perform telemetry reception. For DOVE (AFSK FM), I just tuned to 145.825 and let the bird pass over. (Here, I did not need to tune for Doppler.)

However, for the FO-20 and Pacsat satellites (BPSK SSB), I needed to manually tune for the correct Doppler-shifted signal. This

Specifications

Frequency coverage	140.1–150.0 MHz	
	430.0–450.0 MHz	
	1200 MHz Band (with optional UX-97 unit)	
	50–900 MHz (with optional UX-R96 unit, RX only)	
Tuning step increment	SSB, CW	10 Hz
	FM	5, 10, 12.5, 20, 25, or 100 kHz
	All modes	1 kHz and 1 MHz
Operation modes	SSB (A3J), FM (F3), and CW (A1)	
Power requirements	13.8 VDC ±15%	
Antenna impedance	50Ω unbalanced	
Current drain (2m)	16A on transmit	
	2.5A on receive	
Usable temperature	−10 degrees C to 60 degrees C	
Frequency stability	±3 ppm	
Dimensions	425 W x 149 H x 406 D mm	
Weight	15.0 kg (without internal power supply)	
	17.3 kg (with power supply)	
Output power	5–35W (2m SSB and CW)	
	6–45W (2m FM)	
	5–30W (70cm SSB and CW)	
	6–40W (70cm FM)	
	≤10W (23cm SSB, CW, and FM)	
Modulation system	SSB balanced modulation	
	FM variable reactance frequency modulation	
Spurious emissions	more than 60 dB below peak output power	
Carrier suppression	more than 40 dB below peak output power	
Unwanted sideband	more than 40 dB below peak output power	
Microphone impedance	600Ω	
Sensitivity	SSB and CW	<0.11 µV for 10 dB S/N
	FM	<0.18 µV for 12 dB SINAD
Squelch sensitivity	SSB and CW	<0.56 µV
	FM	<0.18 µV
Selectivity	SSB and CW	>2.3 kHz for −6 dB
		<4.2 kHz for −60 dB
	CW narrow	>500 Hz for −6 dB
		<1.3 kHz for −60 dB
	FM	>15 kHz for −6 dB
		<30 kHz for −60 dB
Audio output power	1.5W with an 8Ω load at 10% distortion	
RIT variable range	±9.99 kHz	
Notch filter range	> ± 1.2 kHz	
Notch filter attenuation	>25 dB	

Table 1. The IC-970H's specifications.

tuning is common, and can be eliminated by connecting additional lines from the PSK-1 to the ACC plug on the rear panel of the IC-970H.

The telemetry sent from FO-20, DOVE, and Pacsat did not require the use of a preamp to receive good packets. All passes I experimented with had elevations of about 25 degrees or higher, and telemetry could be decoded for about three-fourths of the entire pass. Signals were on the average of S-5, with peaks in the range of S-9 to S-20 on FO-20 and Pacsat (SSB), and full S9+40 on DOVE (FM). During these experiments, my antennas were placed to point directly west and at 0 degrees elevation. Obviously, you can get better signals if you point your antennas directly at the satellite.

CT-16 Interfacing

On the rear panel of the IC-970H, a TTL-level remote jack is provided for CI-V converters. This remote jack can also be used to track uplink and downlink frequencies with another radio, such as the IC-1271 or IC-1275 (if you already have one and don't need to buy the optional 1296 MHz module), in conjunction with ICOM's CT-16 satellite interface. This will operate in the manner described above when you are tracking uplink and downlink frequencies in the same or reverse directions.

Pros and Cons

Features I'd like to see:
- •SWR meter.
- •DTMF keypad.
- •A microphone included with rig.
- •Increased output power comparable with other H models.
- •Individually activated preamps.

Features I liked:
- •Automatic tracking for uplink and downlinks.
- •Separate memory channels for satellites.
- •Excellent weak-signal receivers.
- •Great audio quality.
- •Large frequency display.
- •Large multi-function meter.
- •Additional S-meter for sub band.
- •Large easy-to-handle controls and switches.
- •Additional band units can be installed.

It's Worth Buying

Overall, the IC-970H is a great rig for satellite communications and local activity. I found the IC-970H easy to use, and very capable of either voice or data satellite communication modes. 73

Contact Joe Holman KA7LDN at Box 37, Redmond WA 98073. For more information about amateur satellites and satellite operations, contact AMSAT NA at (301) 589-6062.

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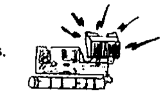

This NEW compact flash assembly comes from a U.S. manufacturer of cameras. Unit operates on 3 Vdc and measures 2 1/2" X 1 1/4". Ideal for use as a strobe, warning light or attention getter. Complete with instruction on how to wire.
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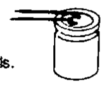

Rubicon CE photoflash capacitor. 0.79" dia. X 1.1" high. These are new capacitors that have been prepped with 1.4" black and red wire leads soldered to the terminals.
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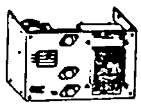

ACDC Electronics # 12N5 or equiv.
Input: 100-240 Vac (wired for 115 Vac)
Output: 12 Vdc @ 5 amps.
Open frame style.
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73 Review

by Dick Goodman WA3USG

Skymoon

Software for EME communications.

Skymoon
9102 Kings Drive
Manvel TX 77578
(713) 331-4200
Price Class: Version 1, $40; Revision 2, $50

One evening in late November 1990, I received a telephone call from Bill Brown WB8ELK informing me that Dave Blaschke W5UN was on the air operating moonbounce. Bill suggested that I try receiving W5UN on 2 meters. I was quite pessimistic about my chances because my antenna system consists of a single Hy-Gain circularly-polarized yagi used for OSCAR satellite operations. I do, however, have a low-noise mast-mounted preamp and a short (60 foot) run of RG-213 coax going to the shack, so I gave it a try.

It took about 10 minutes, but from under all the noise I was finally able (barely) to make out the W5UN's callsign on CW. It was about the weakest signal that I have ever heard, but considering that I was using a single yagi it was quite an accomplishment. I have read articles in several amateur journals stating that the big guns on moonbounce could be received on modest equipment, but I never believed it, until now!

While the "Instant Track" program gave me the azimuth and elevation of the moon, and allowed me to automatically point my antenna, I found there were quite a few other considerations not addressed by this software package for moonbounce operations.

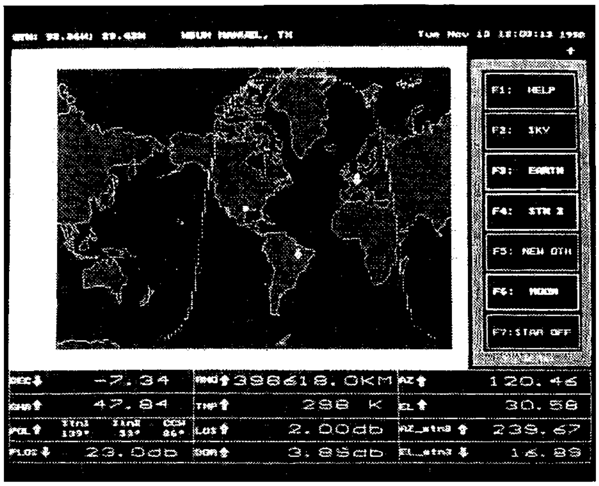

Photo A. Main screen of SKYMOON.

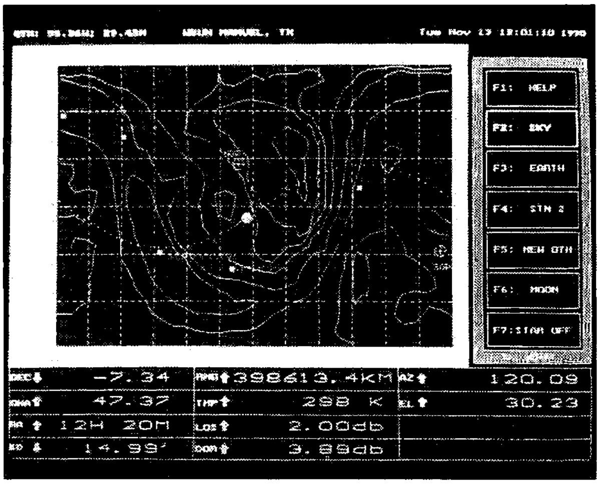

Photo B. Map showing the moon's location in relation to noise sources in the sky, as viewed from your QTH.

Enter: Skymoon

Computer software has certainly evolved in the last 10 years, especially in the field of amateur radio. Since the software developers who write ham radio applications software are usually hams themselves, they are generally technically-oriented individuals. This translates into a useful software package for others with similar interests. Look at the impact of "Packet Cluster," and the variations of logging programs on chasing DX. There are also many effective propagation forecasting programs for determining when DX will be available. For the ham interested in OSCAR operations, there are several good satellite tracking programs which will indicate when the desired satellite will be in view. Now, for the ham interested in moonbounce, or EME (Earth-Moon-Earth) communications, there is a spiffy new software package called "Skymoon," written by Dave Blaschke W5UN, of international moonbounce fame!

I reviewed Skymoon on two different computers: a Beltron AT clone running at 12 MHz with a VGA display, and a Comp-U-Add 386 running at 16 MHz using an EGA, and later a VGA, display.

There are two revisions of Skymoon. Revision 1.0 will run on any IBM PC clone with Hercules, CGA (Mode 4), or a CGA monitor. Version 1.0 comes on a single 5.25" floppy disk, and it can be executed and run from a single drive system. Revision 2.0 comes on two 5.25" floppy disks, and requires either a hard drive or a larger capacity floppy drive (720K, 1.2M, or 1.44M). Skymoon requires 256K of memory to run. For this article, I primarily reviewed Revision 2.0, but I'll provide a brief comparison to Version 1.0 later in the review.

Skymoon is easy to install—you simply copy all the files from the two floppy disks to their own directory on your hard drive. Before you run Skymoon, you must execute a configuration program. This tells Skymoon your offset to UTC, call, QTH, and latitude and longitude.

To start Skymoon, type "SKYMOON" and press <ENTER>. It takes Skymoon about 10 seconds to draw its graphical interface screen. This generates a world map showing the location of the moon and a moon rise/set line (see Photo A). To the right of the map is a menu which describes the purpose of each function key. Below the map are multiple windows of real-time data containing the following information:

- The primary station (your station) azimuth and elevation to the moon (if the moon is not in view, the elevation will be a negative number).
- The current distance to the moon in kilometers.
- The background sky temperature in degrees Kelvin. Depending on where the moon is in relation to noise sources in the sky, this value will change.
- Path loss in dB relative to when the moon is closest.
- Total path degradation in dB.
- The moon declination angle and the Greenwich hour angle (GHA).
- For those used to astronomical positioning parameters, the moon right ascension and the semi-diameter.

Next to each parameter is an arrow that gives the status of each (increasing or de-

creasing). Also, at the top left of the screen are your latitude, longitude, and location name. At the top right is a real-time clock-calendar. Using single keystrokes, this clock-calendar may be stopped, changed in time or date, and restarted. All parameters for the moon at this new time will then be displayed (this does NOT affect your DOS clock). Also included with the clock function is an "East-West Sequencer" which will, if activated, generate a "beep" every two minutes, and display either "East" or "West" on the top of the screen next to the clock. This function is used to determine when to listen or transmit when calling CQ. In Revisions 2.0 and above, pressing the "up-arrow" will generate a listing of the moon's rise and set times for the primary QTH.

The Function Keys

The menu of function keys is quite helpful. Pressing F1 will generate a help screen almost anywhere in Skymoon. F2 will present a map of the sky in place of the Earth (see Photo B). This map is formatted with contour lines of sky noise, with the moon and the path that the moon will take, superimposed over it. Changing the date (or time) will move the position of the moon to its appropriate place on the skymap. F3 will regenerate the map of the Earth.

Function key 4 (F4) is the most versatile function of Skymoon. It allows a second station to be displayed on the real-time map of the Earth, with the following parameters displayed on the bottom of the screen:

- Primary station's (your station) spacial antenna polarity.
- Second station's spacial antenna polarity.
- Antenna polarization correction angle (difference between the above two polarities).
- Antenna polarization mismatch loss in dB.

The second station may be selected by one of three methods. The first is to use the cursor positioning keys to move the "second station indicator" to the desired point on the world map. If you press <ENTER>, this point will be marked with an arrow and all applicable data will be displayed, including grid square, distance, and direct antenna heading. The second method is by direct entry of latitude and longitude. The third method is by direct entry of the grid square. Revisions 2.0 and above let you choose one of the many stations included in the EME station directory (included in this program) as the second station. This directory includes almost all known EME stations in the world, and may be accessed by callsign. Revision 2.0 also lets you compute the moon rise and set times for the second station. *[Ed. Note: Revision 2.1 is now available. Some of the new features are: rapid appearance of the Sky Map and World Map, Az/El direction to ANY point in the sky, single keystroke time changes, metric distance option (km).]*

Function key 5 (F5) will bring up a QTH menu that offers several pre-programmed locations. Choosing one of these will replace your QTH with the one selected (your QTH will be added to the QTH menu, so quick recovery is possible). The world map and related data will now be displayed for the new QTH. Revisions 2.0 and above allow access to the EME directory, and replacement of the primary QTH with any station listed.

Function key 6 (F6) toggles the moon rise-set line on or off. This would be beneficial if you are using the sun grayline function for DXing (see F7 functions).

Function key 7 (F7) is multi-functional. Press it once when the world map is on the screen and the sun symbol and grayline will appear. The azimuth and elevation to the sun will appear in the data windows below. Toggling it several times will profile high and low noise areas of the sky.

This software package also has several features that I did not try. One is the capability to add additional entries to the EME directory.

Version 1.0 of this program (for CGA and EGA) runs noticeably slower. It also doesn't contain the directory of EME stations, and does not have the moon rise-set prediction function.

All things considered, this is a well-written software package that should appeal to anyone who wants to consider EME operations. All screens are logically structured and present the data in an easy-to-read manner. The operating manual is complete and provides a tutorial that will have anyone mastering this program in less then an hour.

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1450G	144-148	10	400	.6	15	13.6	54	UHF
1452G	144-148	25	400	.6	15	13.6	50	UHF
2252G	220-225	25	220	.7	14	13.6	36	UHF
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Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band – specify 10 MHz bandwidth for 420-450 MHz amplifier. Continuous duty repeater amps also available.

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Two Meter EME Primer

Your guide to moonbounce action!

by Dave Blaschke W5UN

Are you interested in EME (Earth-Moon-Earth) operation, but you don't know how to get started? In this article, you'll find out how to determine if your current station is capable of making EME contacts, and if not, what improvements you'll need to make if you want to hear and work EME stations. You'll also learn basic operating information and procedures. You may be surprised to find that if you're willing to spend a little effort, and believe you can do it, it's not impossible to get involved in this exciting area of amateur radio!

EME communications experiments were first conducted by amateur radio operators in the late 1940s. It remained a curiosity and experimenter's mode for many years because most 2 meter stations had poor antennas and noisy receiver front ends. All of that has changed in recent years. Now, almost anyone capable of putting together a reasonably sized station on 2 meter CW can share in this exciting and challenging form of communications.

Photo B. The W5UN EME array is rotated via 2 truck chassis (powered via an electric motor on the driveshaft of one of the vehicles) which literally drive the antenna around a large circular roadbed. The array pivots around a rotating pole in the center. An electric winch along with a series of pulley and cables provide elevation control.

You May Be Set Up Now

In fact, I have discovered that there are many amateur stations currently active on 2 meter CW that are capable of making EME contacts, but they haven't tried it because they don't know they can do it. I've spoken with some who are hard pressed to believe that they are capable of performing such a seemingly impossible feat. But I can assure you that anyone who has more than 100 or 200 watts of power, and an antenna with 16 or more elements, can expect to make a few EME QSOs on moonrise or set, without further station improvements.

Photo A. The new W5UN EME antenna array providing 30.75 dBd of gain (the old array was destroyed by a tornado last March). Dubbed the "Mighty Big Array" or MBA, it consists of a total of 48 stacked long boom yagis (modified M² model 2M5WL).

For the smaller stations who can only run 100 watts or so of output power, a good antenna, which can now be easily built or inexpensively bought, is probably the only other thing needed to accomplish half a dozen EME QSOs. Nowadays, the only amateurs with no chance to participate in EME work are those who run FM only, have only vertical antennas, or use only HTs.

Several hundred amateurs worldwide, many in Europe, are currently active and regular on 2 meter EME. New stations are appearing almost daily. Stations with large antennas and high power, such as my own

100 Countries worked via 2 meter EME!

Photo C. Dave Blaschke W5UN at the control of his moonbounce station after working VS6BI and J79/W6JKV for countries 100 and 101 on October 28, 1990. It took him eight years to reach the century mark (his first EME contact was with K1WHS in 1981). He's currently up to 105 countries worked after contacting CE0ZZZ, 9M8SEA, 7P8EN (Lesotho) and ZS9Z (Walvis Bay). [Ed. Note: Looks like EME could be a great way to avoid those pile-ups to work those rare ones!]

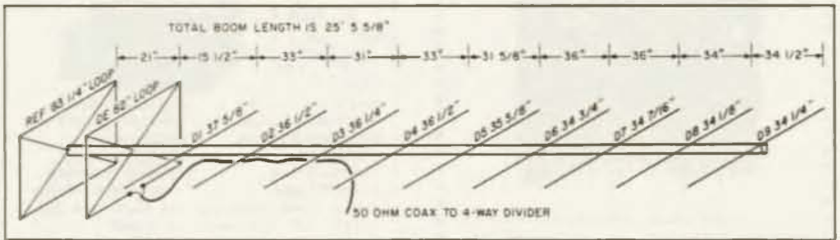

Figure 1. Modified W5UN quagi (optimzed for 144.050 MHz - gain of 13.25 dBd). All directors are ⅛" solid aluminum rod cut to within ±1.16". Reflector and driven elements are shaped into square loops using number 12 solid copper wire with TW type insulation. Leave the insulation in place. Boom is either non-conductive sealed wood or Fiberglas™.

station, W5UN, make it possible for small stations to make EME QSOs today (see Photos A and B).

After *QST* published the article about W5UN's Texas MBA (Mighty Big Antenna) in the January 1989 issue, I was deluged with requests for information and schedules by amateurs who knew nothing about EME communications. Most who wrote or called me had never listened for return echoes before. EME communications requires more structured operating procedure and equipment specifications. For example, antennas must be reasonably sized, and receiving systems must have fairly quiet, sensitive front ends.

Antennas

The first, and most important, piece of equipment needed for EME work is an adequate EME antenna system. Such a system is defined here as one having sufficient elements, properly spaced and phased to yield the gain required for successful EME communications. (Path-loss formulas can give you an idea of the power and antenna gain required.) To communicate by moonbounce, you must be heard by, as well as be able to hear, other moon-reflected signals. It is not known precisely what the minimum gain of an antenna needs to be, but based on a lot of operating experience, I have found that the minimum gain stations need in order to be heard by my station reliably, is around 13 true dB referenced to a dipole when transmitter power into that antenna is no less than 100 watts.

TIME	FIRST 1½ MIN	LAST ½ MIN	COMMENTS
0000—0002	W4ZD de ZD8MB	W4ZD de ZD8MB	Initial transmission
0002—0004	ZD8MB de W4ZD	ZD8MB de W4ZD	Nothing hrd yet by ZD
0004—0006	W4ZD de ZD8MB	OOOOOOO	MB heard calls from ZD
1006—1008	ZD8MB de W4ZD	ZD8MB de W4ZD	ZD didn't hear calls
1008—1010	W4ZD de ZD8MB	OOOOOOO	MB still needs RO's
1010—1012	ZD8MB de W4ZD	ZD8MB de W4ZD	ZD got O's but not calls
1012—1014	W4ZD de ZD8MB	OOOOOOO	MB waiting for RO's
1014—1016	RO RO RO RO RO	RO RO RO RO	ZD got calls and O's
1016—1018	W4ZD de ZD8MB	OOOOOOO	MB didn't hr ZD's RO's
1018—1020	RO RO RO RO RO	RO RO RO RO	ZD sends RO, needs R's
1020—1022	R R R R R R R	R R R R R R R	MB heard RO's, sends R's
1022—1024	R R R R R R R	73 73 73 73	ZD completes the QSO

Table. Example of a scheduled EME contact between W4ZD in Florida (western station) and ZD8MB on Ascension Island (eastern station).

Such antenna and power will permit W5UN to hear you during most of the schedules you're likely to run. A random QSO with W5UN is even possible if a small station calls until heard (this might take weeks or months, but it *is* possible).

"What kind of antenna do I need for an EME station?" is an often-asked question. EME stations use many different types, but the long boom yagi is the most popular. By long boom, I mean boom lengths greater than four wavelengths (about 27 feet). Several of this type are sold commercially. A few which come to mind are the KLM17LBX, Cushcraft 32-19, 42-18XL, Cu-dee, F9FT, and the M² 2M5WL.

For those who find commercial antennas a bit too much for the budget, an inexpensive long boom quagi, with the necessary gain for EME listening and a few QSOs, can be home-brewed (see Figure 1).

Due to computer modeling, advances in design have changed older home-brew antenna dimensions, resulting in better performance. So, if you are contemplating building your own EME antenna, please keep this in mind, and make sure the design you are going to build has been properly modeled and range-tested to ensure optimum performance.

It is possible for stations using OSCAR satellite antennas to hear EME signals from the very large stations. Stations using these antennas have been challenging for W5UN to hear. However, it can be done if such stations will make EME schedules in advance. Recent OSCAR antenna stations worked on schedule by W5UN were CE0ZZZ (KLM22C and 170 watts), KB6BA (KLM22C and 300 watts), and 9M8SEA (unknown OSCAR antenna and 300 watts). The problem with most satellite antennas is that they have circular polarization. This reduces the signal by 3 dB for EME stations, who nearly always use linearly polarized antennas.

The key to all of this is that whatever type of antenna you choose, it must work at its peak capability. Feedline losses, misphasing, and other problems will reduce its effectiveness.

Power

High power is preferred because most stations cannot put up large-sized arrays to make

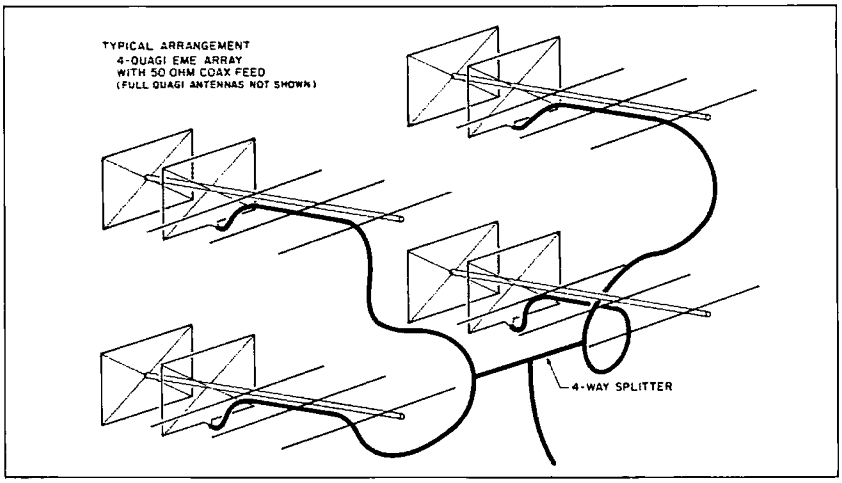

Figure 2. Four quagi EME array with 50 ohm coax feed (full quagi not shown in drawing).

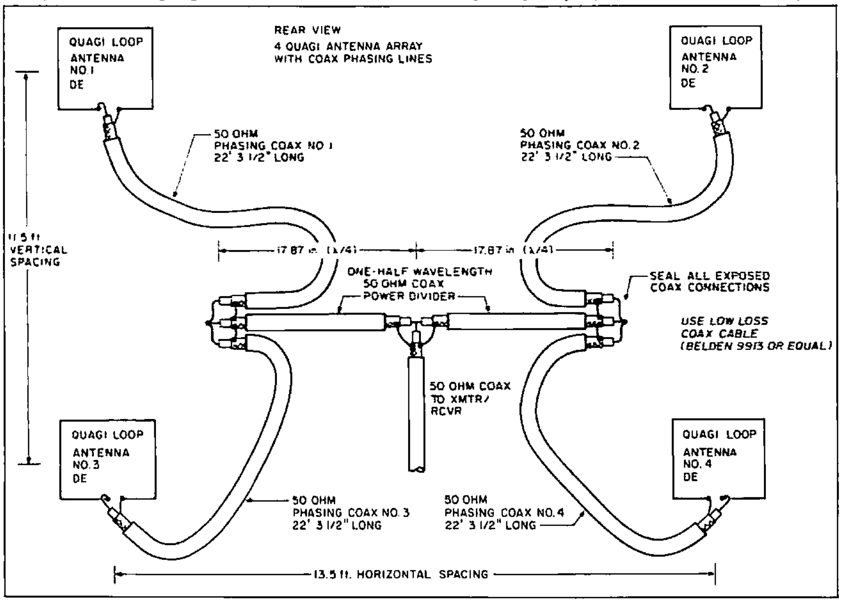

Figure 3. Coax phasing details for the 4 quagi EME array.

up the difference in signal strength levels for EME work. Four good long boom antennas properly spaced, phased, and fed with 500 watts or more, will permit one to make many routine, random EME QSOs on 2 meters. The number of contacts possible with such a station depends upon operator determination and effort.

What is the lowest power station that you can have and still hope for an EME QSO? Well, I have worked a couple of stations who were using a single long boom antenna and running less than 50 watts. In one such contact, W2RS, running 50 watts into a single Cushcraft 32-19 antenna, answered my CQ. I worked another station, ZD8MD, during a schedule. He was running 25 watts to a single 32-19. With higher gain antennas, such as the 42-18XL and the 2M5WL, these contacts could be easily repeated if peak conditions happen to coincide with the schedule time.

Preamplifiers

Your receiver's front end noise figure must be kept below 2 dB if you want to hear those weak moon echoes. If your receiver's front end is not that sensitive, do not despair, a good low noise preamplifier between the antenna and the receiver will perk it up to an acceptable level. Such preamps can be bought or built. They work best if they use GaAsFET transistors, such as the MGF 1302. They also work better when mounted at the antenna, where feedline losses cannot degrade their performance. If antenna mounting is used, some form of relay switching and front end protection must be provided, lest the preamp be blown out by the transmitter power. Many of the solid-state "brick" amplifiers have preamps installed. While these are not usually the best (a preamp with a low noise GaAsFET is the best) they are usually good enough to let you listen to the larger EME stations when conditions are good.

Avoid the use of bipolar transistor preamplifiers. Even though some of these devices can yield noise figures of less than 1 dB, they are susceptible to intermodulation problems, and in some locations can cause birdies to appear all over the 2 meter band. They may work fine if you happen to live in the South Sea Islands where there are no other RF signals, but otherwise, avoid them.

Coax Feedlines

On receive, feedline losses can be overcome by installing the preamp at the antenna. Feedline losses reduce the power transmitted to the antenna, and putting power into the antenna, not out of the transmitter, is what counts in EME work. For example, 100 feet of regular RG-8 coax will have nearly 3 dB of loss at 2 meters.

That means if you start with 100 watts output from your amplifier, you will get only 50 watts into your antenna. Use the shortest possible length of high quality, low loss coax. Your feedline losses should be kept less than 1 dB. As a rule of thumb, Belden 9913 is fine up to 50 feet. Half-inch hardline is good up to about 75 feet. Three-quarters of an inch hardline will work to 175 feet. Beyond that, you will need the bigger stuff. I use a 190 foot length of 1⅝" Heliax from the amplifier to the antenna. Its loss is less than four-tenths of a dB.

Be careful about connectors and power dividers. Losses can increase if a poor connection occurs, or if water gets into connections and power dividers.

Amplifiers

The minimum power you should consider for EME work is about 150 watts. Some commercial solid-state brick amplifiers will produce this. The output of two such bricks can be combined to double the power output, but this can be tricky. If you plan to try it, get the proper information to do it right. For a more serious EME effort, power of 500 watts or more is recommended. Commercial amplifiers are available with power outputs of 1 kW and more, if you're ready for that. Many EME operators have built their own power amplifiers. *The ARRL Handbook* is a good reference for home construction. Sometimes kits are available.

Remember, you do not need high power to start listening for EME signals, or to make contacts with the large moonbounce stations.

Where, When, and How to Listen

EME work on 2 meters is primarily done on CW, sometimes on SSB, but never on FM. Signals are very weak echoes reflected from the moon's surface. To hear such signals requires a receiver with a reasonably low noise front end (most commercial receivers are not good enough, but a relatively low cost preamplifier can fix that). A well-designed antenna in good working condition must be pointed at the moon. This can be done without elevating the antenna if you can catch the moon during the hour or so after it rises, or before it sets. In fact, when there is EME activity, these are the best times to hear EME echoes using a rotatable antenna that cannot be elevated. If your horizon is relatively clear and flat, ground gain enhancement is possible during rise and set periods. Moderate EME activity occurs often on weekends when the moon is

in a favorable sky position. Activity peaks when the moon is within common view of both Europe and North America. Random activity can be found from 144.000 MHz to 144.020 MHz. Schedules are run between 144.020 MHz and 144.100 MHz. Single sideband voice is sometimes heard on 144.105 MHz. I usually operate CW on 144.008 MHz during such times, and also on weekdays after work. Many CQs are called by myself, W5UN, and others during these times.

Schedule Making

EME operation is either random (calling and answering CQs), or scheduled. Let's discuss schedule operating procedures first. Schedules are made in several ways. The best way is to check into the 2 meter EME net beginning around 1730 UTC every Saturday and Sunday on 14.345 MHz. Direct telephone calls to the station you want to make a schedule with is another way. I've set up many schedules with small stations this way. A third way is to request a schedule by mail.

Schedules usually last for one hour, but may be longer or shorter as agreed to by the participants. Smaller stations usually run schedules for one hour. During schedule making, a frequency and time are agreed on, and the two running stations are designated as being either east or west, depending on their relative location to one another. When a schedule begins, the eastern station transmits for the first two minutes beginning at the top of the hour. If the schedule starts at a time other than the top of the hour, the same two-minute periods are used as if the schedule had started on the hour. If you are running a schedule with a station to the east of you, that station would be the eastern station, and you would be the western station. The two-minute transmit/receive sequencing will continue until the schedule is completed or until time runs out.

For successful 2 meter EME QSOs, you're required to exchange callsigns, O's, RO's, and R's. This data must be received and acknowledged by both stations. 73s are usually sent also, but this is optional information. Let's consider a schedule example.

The table illustrates how a schedule between W4ZD in Florida and ZD8MB on Ascension Island might progress, and shows how the information discussed above is handled. Let's say they have a one-hour schedule starting at 1000 GMT. ZD8MB is east of W4ZD, so he is designated as the eastern station, and will transmit the first two minutes. ZD8MB will send calls over and over for the full two minutes (W4ZD de ZD8MB).

W4ZD begins sending at 1002 GMT. If W4ZD heard the calls, he will send ZD8MB de W4ZD for the first minute and a half, and O's for the last half a minute. If W4ZD doesn't hear both calls, he calls only for the full two minutes. This continues until either station has heard both calls and O. Once an O is heard, the station hearing it responds with RO's during his next transmission for the full two minutes. The station copying RO's has received sufficient information for his part of the QSO. When the station transmitting RO's hears an R, that station has received sufficient information for his part, and the QSO is essentially complete. Most stations, upon hearing R's, will respond with R's and 73s to let the other station know that R's have been received.

Random QSOs

Having read all that about two-minute sequences, you will find that a lot of random activity is conducted with one-minute sequences. In fact, nearly all my random QSOs are of the latter type. If stations are hearing each other well enough to copy random calls in one minute, additional time is not necessary.

Random activity is quite a challenge for the less equipped, smaller station. However, by answering the CQs of larger stations transmitting on the bottom 20 kHz of 2 meters, it is possible to make QSOs. It is well-known that the signal level of a scheduled station can be several dB less than that of the weakest identifiable random calling station. A listening operator can mentally fill in the missing parts of a very weak station's call when he already knows what the call will be. Also, when the operator knows a certain station will be calling on schedule, he shifts his ears (and brain) into a more focused, selective mode in order to dig that station out of the noise. For these reasons, small stations are urged to make advanced schedules whenever possible. However, don't give up on answering random CQs, because you never know if success is possible until you try.

I must tell you one more thing about schedules and the pre-knowledge of callsign information: It takes discipline to assure yourself that you're hearing what you think you're hearing when you dig deep into the noise for long periods. Some operators can manage this self-discipline better than others. Remember, you will only shortchange yourself and the station you are scheduling if you acknowledge QSO information that you have not truly heard, but only thought you heard or, worse, have guessed at. This is another reason why I enjoy random operation: I don't have to be as disciplined about what I thought I heard, since I actually must hear the full call to know who is calling.

The Effects of Conditions

A signal of constant strength transmitted from Earth and then reflected back never yields the same signal level in a receiver from one moment to the next. There are many factors which cause this phenomenon. Some of these factors are well understood and predictable. Some are only partially understood and are not so predictable. There are probably a few factors that haven't even been thought of yet. Some of the signal variations are short-term (such as those caused by moon/Earth libation), and some are long-term, such as those caused by Earth/moon distance separation. Libation effects are very short-term (milliseconds) and are of little interest to EME operators. Longer-term factors are of great interest because EME scheduling and operation times are chosen based on a set of such predictable factors. I will explain these factors shortly. There are also some factors which cannot be predicted in advance, but which can greatly affect EME communications. I will briefly discuss these also.

The distance of the moon from Earth, the position of the moon in the sky (that is, the background sky when looking at the moon), and the phase of the moon during its 29-day cycle all have well-known effects on reflected echo strength, relative to system noise. During the 29-day cycle the moon ranges from apogee (furthest from Earth) to perigee (nearest to Earth). At apogee, the strength of a returning echo will be about 2 dB less than it will be at perigee, all other things being equal (which they seldom are). Also, during the 29-day cycle of the moon the background sky noise levels at 2 meters will vary from 175 degrees to over 5000 degrees Kelvin. (The higher noise occurs when the moon is positioned against the galactic plane, which happens near the moon's most southerly declination.) This noise equates to dB readings from 1.75 dB to over 10 dB. Sky noise and path loss are the key data elements used by EME operators to determine the best operating times during the moon cycle.

Factors affecting the moon which are not so easily predictable are the effects caused by the Earth's geomagnetic field as the signals pass through it on the way to and from the moon. One such effect is Faraday rotation. This causes the polarity of signals to rotate from horizontal to vertical and back. Faraday rotation can cause a signal to null-out (or peak) depending upon what type of polarity your antenna has. Polarity seems to rotate quite naturally at about 15 minute intervals when the geomagnetic field is normal. However, things are seldom "normal" with the geomagnetic field (despite what WWV says), and sometimes rotation locks up for long periods of time. Another situation caused by geomagnetic activities is where signals seem to be dispersed or absorbed, rather than rotated. At such times, it doesn't seem to make any difference what your antenna polarity is. Even if you could rotate polarity (as some stations can) it wouldn't help. I have also heard signals greatly enhanced in strength when the geomagnetic field was disturbed, although many times when this happens, communications is one-way, and stations at more northern latitudes will hear nothing for long periods of time. Then the situation reverses, and the southern stations are locked out. So, it is difficult to determine in advance just what the effects will be for a given time and condition. There is still a lot to be understood about such effects on EME communications before predicting methods can take them into account.

There are are a few other rules of thumb about EME operating conditions. Overall, nighttime seems to be better than daytime for EME operation (perhaps because ionization and consequent absorption is less of a problem). But I have heard some very good condi-

tions during daylight, so don't give too much weight to this. Winter, on the average, seems to have better EME conditions than summer, probably for similar reasons.

The new moon can affect EME communications. Noise from the sun will mask weak signals during new moon. The moon is not usable for EME work for about two days centered around the new moon date. There will be many days during the cycle when the moon cannot be seen because it is up during daylight. EME communication is quite possible most of these days, if you can aim your antenna without seeing the moon.

Computer Programs

A number of programs that compute moon-tracking data, essential to scheduling and antenna-aiming, run on ham shack computers. The best of the more modern programs run on IBM personal computers. Other computer software for Commodore computers, HP calculators, and others, can still be obtained, or even easily written.

Good moon tracking programs, such as W5UN's SKYMOON, VK3UM's REALTRACK, and WA1JXN's TRACKER, will give excellent directional antenna-aiming and a lot of other pertinent EME data. *[Ed. Note: see the review of SKYMOON in this issue]* Many EME operators use such programs to find the moon's azimuth and elevation (Az/El) from any given point on Earth at any given time, so that they can arrange mutual schedules. In addition to moon position, these programs give moon apogee and perigee information, and moon background sky noise estimates for each Az/El time interval calculation. Some programs go beyond this and also compute many other variables of interest to EME operators.

EME Directory

"The EME Directory," available from Bev Cavender W4ZD, P.O. Box 88, Lake Placid FL 33852 is a good resource to have if you wish to know who the worldwide, active EME stations are, and what kind of station equipment they are using. The directory is also part of revision 2 of the SKYMOON program.

2 Meter EME Newsletter

"The 2 Meter EME Newsletter," published by John Carter KØIFL, P.O. Box 554, Union MO 63084 about 10 times per year, helps keep EME operators informed about who is active on EME, and who is working whom.

2 Meter EME Net

As I mentioned previously, the 2 meter EME net meets every Saturday and Sunday around 1730 UTC (after the 70cm net finishes) on 14.345 MHz SSB. This is the "watering hole" where EMEers gather to exchange information and make schedules. Newcomers are welcome to check in. VE7BQH is net control. 73

Dave Blaschke W5UN can be reached at 9102 Kings Drive, Manvel TX 77578.

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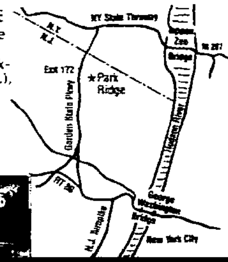

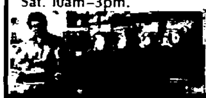

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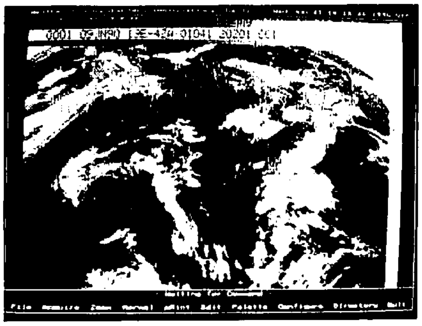

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Hams in Space!

SAREX II, the next generation.

by Philip Chien

At 11:41 a.m. on December 2, the night sky lit up over Florida with a spectacular display of flame and smoke as the Space Shuttle Columbia headed for orbit. After a series of delays (caused mainly by a persistant hydrogen fuel leak), STS-35 and SAREX II-01 was finally on its way! STS-35's primary mission was to carry NASA's Astro-1 spacelab with three ultraviolet telescopes to observe the universe in ways never viewed before. Operating NASA's own Goddard Spaceflight Center's Ultraviolet Imaging Telescope (UIT) was payload specialist Ron Parise WA4SIR. In 1978 UIT astronomer Ron, a ham since 1962, was completing his graduate studies at the University of Florida, and by 1980 he was part of the UIT team. Little did Ron realize then that he'd be flying with the UIT instrument he helped develop.

The UIT is best described as a sophisticated telephoto camera with super-sensitive film and a violet filter. Imagine a telephoto camera with a field of view 25% wider than the full moon with ultra-low-light film with an effective ISO (ASA) of a couple of hundred thousand (in comparison with the 100-400 film you'd normally purchase). It has a filter so violet the human eye can't see it, further into ultraviolet than Hubble's capabilities. Also, instead of an 18 or 36 exposure roll of film, you have a film pack with over 1000 exposures of 70mm film! That's one heck of a telephoto camera!

SAREX II

The launch of the Astro 1 mission marked the beginning of a new series of SAREX (Shuttle Amateur Radio EXperiment) flights.

The primary mission of this SAREX was to communicate with a number of classrooms across the U.S., as well as to provide hams worldwide a way of directly connecting up to the shuttle via a packet radio robot.

In addition, Ron recommended trying ship-to-ship contact between *Columbia* and the Soviet space station *Mir*. He said, "The idea came to me some time ago, just because here was *Mir* operating 2 meters and we were going to be operating 2 meters, and we ought to talk to each other."

Any *Columbia*-to-*Mir* contact would be much easier from the Soviet side than from the U.S. because *Mir's* ham shack includes a 25 watt transceiver and an outside antenna, while the *Columbia* has an inside antenna and 5 watt transceiver.

Photo A. Ron Parise WA4SIR working the world from the SAREX operating position onboard STS-35. Photo courtesy of NASA.

Photo B. Mission commander Vance Brand talks with family members via the SAREX 2 meter link. Photo courtesy of NASA.

Contact between the two vehicles is complicated by two factors. The most obvious problem, the Doppler shift, actually turns out to be fairly insignificant. More complicated is the motion of the two spacecraft. Since the spacecraft are in different orbits at different altitudes, and traveling in different directions, the range between the spacecraft and the line of sight angle changes quickly: One minute you're several thousand kilometers from each other, the next you're right next to each other, and then you're several thousand miles away again.

Low Inclination

Unlike the earlier ham radio shuttle flights, Astro was launched into an orbit with an inclination of 28.5 degrees, the typical orbit for most shuttle flights. Spacecraft launched to the east gain extra payload capacity due to the Earth's rotation: A spacecraft launched due east can carry the most payload; the orbit is inclined to the equator at the same angle as the latitude of the launch site. The end result is that Astro flew no further north of the equator than the KSC launch site, and at the same latitude to the south, 28.5 degrees. The Spacelab 1 mission with Owen Garriott W5LFL and Spacelab 2 with Tony England W0ORE flew into higher inclination orbits for better Earth observation capabilities, the trade-off being less payload.

The irony is that the Soviet space station *Mir* is in a 51.6 degree orbit, halfway between the Spacelab 2 and Spacelab 1 orbits. Had Astro been launched into a higher inclined orbit, longer opportunities for *Mir* contacts could have been possible.

Photo C. Matt Flagg, a senior at New Prairie High School in New Carlisle, Indiana, and Jim Fonte KK9T (r) make the first school contact with WA4SIR in the shuttle Columbia. Teacher David Washburn WB9QJL (l) looks on during this historic contact. Photo by Steven Peterka WD9FGZ of the News Dispatch.

Due to the 28.5 degree orbit and Ron's schedule, he was awake primarily when flying over Australia, South America, and Southern Africa; however, Astro's altitude made it possible for most continental U.S. hams to contact SAREX within line-of-sight requirements, even though it was at relatively low angles.

Schools and Packet

Since the 1985 Spacelab 2 flight, many improvements have been made to the space ham equipment, expanding the capabilities for SAREX contacts. For example, the original antenna on Spacelabs 1 and 2 could only be used in the overhead windows, which interfered with Earth observations. The new antenna (made by the Motorola Amateur Radio Club in Shaumburg, Illinois) mounts in a side window where it's out of the way and doesn't require any particular orientation. Ron did have minor problems moving the antenna across the flight deck, crowded as it was with crew and equipment, to other windows, but he managed to do it without interfering with Astro operations.

In this latest mission, relay links with teams of Australian, South American, and South African hams relayed the SAREX signals back to classrooms via an elaborate telephone/radio linkup. Most important for computer-oriented hams was the addition of the packet mode, including the capability to operate SAREX in its robot mode continuously during Ron's shift without interfering with his other responsibilities. The packet TNC was a Heath HK-21 with special robot software written by Howie Goldstein N2WX.

As it turned out, Astro was launched just a couple of hours before the Soviets launched their TM-11 mission with Victor Afanashev and Musa Manarov, a handle familiar worldwide with hams. He flew a year-long *Mir* mission in 1988 as U2MIR/UV3AM.

Record Numbers in Space

The dual launches on December 2, 1990, resulted in 12 people in orbit at the same time in three separate spacecraft: seven Americans aboard *Columbia*, two Soviet long-term cosmonauts finishing their mission aboard *Mir*, two Soviet long-term cosmonauts starting their mission, and a Japanese journalist aboard the TM-11 Soyuz spacecraft.

On the second day of the *Columbia*'s mission, *Mir* passed within 50 km. Mission specialists Jeff Hoffman and Mike Lounge said that *Mir* looked like a moving star. Unfortunately, they couldn't attempt a 2 meter contact because the Soviet crew was busy performing their post-docking tasks. Since contact would be possible *Mir* later in the mission, the attempt was rescheduled.

First Contacts

While the Astro crew didn't get a chance to talk to *Mir*, thousands of ground-based hams around the world were able to communicate with Ron Parise aboard the *Columbia*. Hundreds of students, teachers, and individuals spoke with him directly during brief contacts. Ron used some of his spare time, before sleep and after waking, and before going on 12-hour duty, to communicate with the world. He operated SAREX every time he had a couple of spare minutes.

After Ron got a chance to set up the SAREX gear, he prepared for his first voice contact as he passed back over the Kennedy Space Center launch site. His first voice QSO was with NZ8W, a ham operating a 45 watt car rig outside a hotel near the launch site. Appropriately, NZ8W happens to be Henry Parise, Ron's dad.

Due to the tight crew schedule, the other astronauts didn't get a chance to use SAREX much except for pre-planned phone patches with their families.

One of Ron's more unusual voice contacts was with mission manager Jack Jones KC4IWU. Normally mission managers only talk to the crew through the spacecraft controllers and capcoms, but Jack went over to the Marshall Spaceflight Center's ham shack and talked with Ron for a couple of minutes about how well things were going, and how proud the ground team was of the job the crew was doing.

One lucky young ham in Hawaii, newly upgraded to Technician, contacted Ron. Thoroughly enjoying himself, Ron talked for a couple of minutes about activities aboard the shuttle. Unfortunately, due to technical

Photo D. Charley Shumaker N8IKP, Barbara Curry N4TCC and Ron Curry WA4GSS (standing left to right) discuss the joys of amateur radio with students of several schools from the Huntington, West Virginia, region just prior to making contact with STS-35 during 2-way session number 3. Photo courtesy of Ron Curry WA4GSS.

Photo E. Fifth grader Crystal Stuart of Everett, Washington, anxiously waiting to talk with WA4SIR. Thousands of students in the Mukilteo School District #6 listened in via 2 meter rigs, donated by ICOM, located in many area schools. The Evergreen Intertie (linked repeaters connecting the northwest U.S. and Canada) allowed students in Washington, Oregon, Idaho, Montana and Canada to listen as well. Photo courtesy of Larry Luchi W7KZE.

problems aboard the orbiter, Ron wasn't able to record the conversation or copy down the callsign. If you're that ham or know who it was, please contact Ron!

During the mission Ron had the chance to make several sets of voice passes over the U.S., a couple of passes over Australia, and two over South Africa. Ron even made contacts with some portable rigs. When Ron tried a few free-for-all uplink contacts, literally thousands of hams transmitted at once on one uplink frequency. Ron said at times it sounded just like white noise on his end.

Besides individuals, Ron made 28 prearranged contacts with student groups around the country, primarily via voice relays through Australia (VK2AS, VK5AGR and VK6IU) or Brazil (PY2BJO), although one contact was made directly from the *Columbia*. One of the teachers at Tampa Palms Elementary School in Tampa Florida is Cathy Blair, astronaut Sam Durrance's sister. At 8:42 p.m. EST on December 8 (6 days 18 hrs. 55 minutes MET), Ron called Lee Paulet KB4FBX, who had set up a rig in the schoolyard with the assistance of Robert Osband N4SCY. With the help of two other hams, N4SCY provided a real-time computer display showing the shuttle's position.

After Ron made the initial contact with Lee, he passed over the handset to Sam, who talked to the students for about four minutes, before the shuttle went out of range. Ron said, "It was natural to let him [Sam] talk to the kids and answer the questions."

Though it was a Saturday evening, approximately 200–300 students came over with their families to hear the shuttle in person. Local and regional newspapers, radio stations, CNN and television stations from all three networks covered the contact. Several students asked Sam questions about life aboard the shuttle, and everybody was entertained—and educated. While the contact took up four minutes of valuable shuttle time, it helped educate hundreds of students, and indirectly affected thousands of others who learned about this SAREX contact with a small elementary school in Florida. This is one of the fine examples of how the SAREX experiment has helped educate the public about the space program and ham radio activities.

Packet Robot

One of the most exciting aspects of the flight was the capability to operate the SAREX experiment almost 16 hours a day, even when Ron was on duty. Packet radio made it possible for Ron to leave the rig running as a mini-packet BBS while he was busy working with the Astro telescopes. (For details about SAREX hardware and procedures, see the article "SAREX-90" in the May '90 issue of *73 Magazine*.)

The SAREX TNC held two lists of contacts: a work list with a capacity for 600 confirmed QSOs, and a heard log for up to 32 incomplete QSOs.

The work list holds the names of the 238 lucky hams who completed the entire contact, acknowledgment, and receipt of acknowledgment procedure (see "Hamsats" in this issue). The heard log held the last 32 hams who made contact, but who hadn't completed the entire procedure. The heard log was broadcast as a QRZ beacon with its current list. Whenever Ron got a chance in between observations on the shuttle's flight deck, he would go down to the middeck where the SAREX experiment was located and dump the heard log from the TNC to the PGSC (Payload General Support Computer), a modified GRID laptop computer. The PGSC, onboard the shuttle since 1983, has proven itself so useful in monitoring experiments and collecting data that NASA is planning to replace the French-built DDS (Data Display System) Spacelab computers with them.

Ultimately, Ron got 672 callsigns in the stored heard log, including duplicates. The ROBOT's counter exceeded 1700 contacts. Unfortunately, he couldn't constantly dump the log, and it kept overflowing. The only record of the lost log entries is the QRZ beacons, and they're needed to reconstruct the log. Ron told me, "We need any QRZ beacons that anybody's got on disk or in hardcopy." If you've received and copied a QRZ beacon PLEASE send a hard copy to the ARRL, 225 Main St., Newington CT 06111. Or send it via packet to *SAREX @W3IWI.MD.USA* or SMTP Internet mail to *SAREX@TOMCAT.GSFC.NASA.GOV.*

Astro's final target, the comet Levy, was high-risk. Ironically, each of Astro's launch attempts involved a comet: Halley's in 1986, Austin in May 1990, and Levy in September 1990. When Astro was launched in December, Levy was too close to the sun to permit safe observations. However, the managers decided to attempt observation of Levy, since, as the last target for the mission, it wouldn't matter if the sensors were overloaded.

Unfortunately, while everything was working fine in orbit, the weather on the ground didn't cooperate. Mission controllers decided to bring *Columbia* back a day early to avoid the bad weather.

A more important impact to the reduced length of mission was the failure of the *Mir* contact, scheduled for nine days into the flight. The Johnson Space Center hams responsible for SAREX were unable to complete arrangements for a quick, last second *Mir* contact on the final day, even though they went as far as phoning their Moscow contacts.

Columbia completed its tenth spaceflight, and the Astro mission, on December 10, 1990, at 9:54:08 p.m. PST, when it landed on concrete runway 22 at Edwards AFB in California. When Astro flies again, backup payload specialist Ken Nordsieck will fly with either Ron or Sam. I asked Ron if he'd like to fly with SAREX again, and his reply was an enthusiastic "Sure!"

Philip Chien is an aerospace and technical consultant with over 350 published articles in the aerospace and computer industries. He has covered the space program from the Kennedy Space Center since 1983, and computers and telecommunications since 1984. He has been promising to get a ham ticket for the past two decades, and will take the tests "any day now." Honest. Look for a callsign before the next SAREX flight.

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton CA 92633

ELTs and EPIRBs Revisited

Right now it's evening and I'm looking out the window of an L-1011 jumbo jet that has just taken off from the Dallas-Fort Worth airport. Reflections from street lights in the new subdivision below make the roads stand out like dotted lines. I wonder if anyone has put on a hidden transmitter hunt in this part of town yet.

Thinking of flying and foxhunting makes my mind wander back to a night in the summer of 1982 when I was among a group of hunters waiting for the last vehicle to find the T on a hillside in rural Yorba Linda, California. We idly noticed a Cessna four-seater above the hills to the east.

All of us then looked away except April WA6OPS, who saw it abruptly nose over and disappear behind a hill. A few minutes later we heard emergency vehicles on the freeway below. Still later, we learned that the plane had crashed near the freeway, killing all aboard.

That mishap occurred very close to a populated area, and nothing could have been done to save the victims. But aircraft, boating, and hiking accidents often have survivors who need to be located and rescued from dangerous situations before their injuries claim them. That's where skilled volunteers who know radio direction finding (RDF) enter the picture.

"Homing In" readers are interested in search and rescue (SAR), and they have strong opinions. I know, because they responded in record numbers to the October and November 1990 columns on the subject. In those issues, I explained impact-activated 121.5/243.0 MHz Emergency Locator Transmitters (ELTs) for aircraft, and their maritime counterparts, EPIRBs. I told about a new Personal Locator Beacon (PLB) service for hikers and campers, called PELTS, that was originated by KA7OSM and proposed officially, in a much different form, by the FCC. I asked you to let me know your thoughts.

Reader Reactions

J. C. Arenburg W4DZA, a major in the Civil Air Patrol (CAP) reminded me to mention that an injured person's chances of survival go down by 80 percent in the first 24 hours, so the rescuers' speed is vital. "Constant practice is important," he writes.

Henry Mosely KA1RRT of Grafton, Vermont, sent along a page from a catalog he received, advertising for $100 a "Human Emergency Locating Transmitter" that "can save your life." The ad goes on to say: "Transmits SOS via satellite to US Air Force Rescue Center. Rescue teams 'home in' on your signal. Field tested and government approved."

Government approved yes, but only for aircraft or boats in distress, not individuals. The ad fails to mention the $10,000 fine that can result from improper use. "Hunters and hikers will be (accidentally) turning them on in their tents," he worries. These ELT clones transmit continuously when activated, so the signal from a false alarm can cover up a legitimate distress signal.

On the other hand, many writers are concerned that there is an excellent satellite-tracked emergency beacon service for boaters and aviators, but nothing similar for wilderness users. Bruce Wright N8MWL is a frequent backpacker. He is working on a QRP ham rig for hiking, instead of buying an ELT clone. But he would prefer to be able to call for rescue on the frequency that is presently most likely to evoke a response: 121.5 MHz.

"It would not matter if it is illegal," Bruce wrote. "A jail cell would be a welcome alternative to most emergencies. This attitude is why so many ELTs are in use (by hikers)." N8MWL wants a separate satellite-tracked and aircraft-monitored PLB system for the general public that could get response like the 121.5 MHz system does, and adds, "There's no reason for aviators to have a corner on the lifesaving market."

Almost no one liked the FCC's PELTS proposal, which called for PLBs with nine ACSSB voice channels and one homing channel near 220 MHz. Typical responses: "If it had been approved, PELTS was going to be a total, absolute disaster!" and "I agree with you on PELTS. No voice!"

By far the most deeply-researched response came from Lou Dartanner N6ZKJ.

Lou sent a four-page typeset document titled "Personal Locator Beacons—A Status Report," which she prepared for her company. It gives a wealth of general information about PLBs, and summarizes the discussions at a full-day seminar on the subject put on by the International Committee on Search and Rescue (ICSAR).

Every paragraph is packed with useful information. There is no way I could cover in this limited column space the depth of thought and analysis that has gone into the ICSAR seminar and N6ZKJ's report.

What are other countries doing to implement PLB systems? Will inexpensive PLBs encourage hikers to take unnecessary risks because they can easily call for help? Should there be fines for persons who generate false alarms with PLBs?

Did you know that alerting and homing systems using call boxes and short-range transmitters are now being developed and tested for use within the confines of national parks and small wilderness areas? This report gives more details. What are the liability issues faced by responders to PLBs?

Could SAR organizations be sued for not rescuing someone in time? That's in the report, too.

The report also tells about global locating systems on the drawing boards from several companies, including Orbital Communications, American Mobile Satellite Corporation, Atlantic Research Corporation, Qualcomm, Geostar, Starsys, and Motorola. If you would like a copy of N6ZKJ's report, send an SASE to L-tronics, 5546 Cathedral Oaks Road, Santa Barbara, California 93111, and ask for the report by name.

Lou recognizes the potential for overload of the present 121.5 MHz SARSAT system, but would still like to see it used for wilderness PLBs, since SAR teams are already equipped for it. Equipping volunteer rescue teams for a new system on a different frequency would be costly, she says, and would slow the implementation of this badly needed service. If ELTs and PLBs transmitted intermittently instead of continuously, then false trips would not "jam" emergency transmissions.

Photo A. It's that one! Steve Kirkman KB6IMB (left) and Jim Frank KB6ONC of the Los Padres Search and Rescue Team have found another squawking ELT at the Santa Barbara airport with their L-Per RDF set. (Photo courtesy N6ZKJ and K6IA.)

Ask An Expert

Lou Dartanner knows a lot about hunting for ELTs; she has done it for almost 20 years. Lou and her partner Bruce Gordon N6OLT founded L-Tronics when ELTs became mandated for certain aircraft in 1972. The SAR community needed a complete, lightweight RDF unit that could be used in vehicles, on foot, and from aircraft.

Bruce designed the "Little L-Per," and Lou built the first 100 units. When they sold out immediately, Bruce and Lou knew they were headed for success.

Today the L-Per, with its two switched vertical antennas, is the "standard issue" RDF set for CAP and SAR groups all over the USA and the world.

The L-Per's self-contained four-channel crystal-controlled receiver was designed for popular SAR training and operational frequencies, such as 121.5, 121.6, and 243.0 MHz. But, with a change of crystal and a little tweaking, it will work on the amateur 2 meter and 1¼ meter bands. Despite its four-frequency limitation, many RDF competitors rely on L-Pers for on-foot sniffing duty during foxhunts.

Lou has not given up on her commitment to SAR. In fact, she is more active than ever, and says, "I still learn something every time I go out." Dedicated volunteers like N6ZKJ make the Los Padres Search and Rescue team (LP-SAR) one of the most active and well-respected groups of its kind in the country. (See Photo A.)

LPSAR, an auxiliary of the Santa Barbara County Sheriff's Department, has a Memorandum of Understanding with the Santa Barbara Amateur Radio Emergency Service. ARES members become part of search teams to provide vital communications and RDF services. It was her desire to be able to use Amateur Radio for SAR efforts and to facilitate ELT alerting that led Lou to get her ham license.

Early Warning

According to N6ZKJ, a majority of ELT/EPIRB trips occur in the early afternoon, but SAR groups are often not activated for several hours while satellite fixes are performed, the FAA checks flight paths, and the callout request goes through the chain of command. When volunteers are alerted in the evening and nighttime hours, it's harder to organize the team because facilities are less accessible than they are during business hours.

To reduce the delay, L-Tronics developed an automatic alerting system for Santa Barbara County hams. A 121.5 MHz receiver is incorporated as part of the K6TZ repeater, overlooking Santa Barbara Harbor. When an ELT or EPIRB signal trips the receiver, the

Number 14 on your Feedback card

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Third Term for the C-64

As we go Marching along, I find myself mired in a pile of letters! To wit:

Rick Arzadon WA8RXI of Taylor, Mississippi, says he reread the "RTTY Loop" column of November 1989 and became interested in the "ThirdTerm" terminal program originally offered by Jack Skubick K8JS for the C-64 computer system. According to Rick, Jack no longer has a C-64 system, and therefore no longer provides "ThirdTerm" for it. Rick is looking for a source of this program.

I don't have a Commodore system here, so I really can't help on this one. I would love to hear from some of you, though, who could provide this shareware program to fellow readers.

Rick also says that he has a receive-only packet program and interface obtained locally for VHF reception, and that he is looking for a multimode terminal unit. He asks that age-old question, "Of the three controllers, the AEA PK-232, Kantronics KAM, and MFJ-1278, which one has the best overall performance receiving and transmitting?"

The simple reason that I have never directly answered this question is that I do not have the data. While I have one of the three controllers here at WA3AJR, the only information I have on the others has been picked up from conversations with other hams, advertisements, and review articles. That I know of, no one has ever done a real head-to-head comparison of these three top-end machines, and in all likelihood, there may be no real point to doing so. I suspect, from what I've seen and heard, that differences in terms of signal acquisition and decoding are minimal. There may be bigger differences in features or operations, but that gets more into the line of personal preference than true ratings.

So, I guess the bottom line is to see if you can find someone with a unit you have in mind, go over to their shack, and play with it for a while. Like a car, some folks prefer Chrysler, some GM, and others Toyota. None of these are better or worse, just different.

This, That, and Something Else

Speaking of "different," I received a letter from S. Roy Luxemburg N5QQM currently residing in Singapore. In part, Roy says that [thanks to "RTTY Loop,"] "I purchased a Model 35 from Western Union in 1981. I had thought to use the former TWX service with WU, and . . . [also be able to] . . . connect it with ham radio. Talk about lamentable ignorance! I still have the machine, but it turned out to be *almost* a white elephant.

"In an attempt to follow my keen, if unfulfilled, interest, I continued to slowly accumulate information and equipment. Then came the wonderfully informative issue of *CQ Magazine* for November 1983. That did it. I bought a HAL CWR 6850 . . . and got a clue about SWLing with RTTY!

"But I wasn't there yet. My subscription to *73* ran out and I decided not to renew after several years. To make matters worse, I had allowed my license to lapse (sheer negligence in the light of the foregoing!) and recently re-acquired a license. Now I also have a Tono I5000E and two, count 'em, *two* AEA MBA-RCs for code conversion.

"I then built a Heath Ultramatic Keyboard to get from Morse to RTTY and ASCII. Along came AMTOR—great, but I think RTTY is still the best.

"Reading your column this morning was a costly enterprise. Hll I spied *73* in a magazine rack on Orchard Road, a great shopping area here in Singapore. The price of *73* was S$10.60, which is more than $6 in the States! That did it. I'm subscribing again, today.

"We are rich in vacuum tube equipment at N5QQM, having about 25 Collins and Hallicrafters receivers, two KWS-1s, SR-400A, four or five HT-32s, one HT-20, and an HT-1 (!), as well as a 32V2 and 32V3, CE200V, and on and on . . . .

"Do you ever write about the old gear? FSK generation for the old vacuum tube transmitters, possibly? How about stuff on the many special things you've done with the old stuff?"

Well, Roy, about the most impressive thing I've done with the "old stuff" is get rid of it at the wife's insistence. But seriously, I have covered the gamut here, from shift pot circuits to tuned tanks. I am always willing to re-examine an old topic, so just let me know what turns you, or your system, on.

Computers and RFI

Another note, this one from Dick Peters WA1PWF of Norfolk, Massachusetts, deals with the eternal question of RFI. Dick tells us that he is using a Tandy 100 laptop for RTTY, AMTOR, and packet, and he would like to go for a big PC clone, but wonders about RFI.

He is aware of the FCC classifications of computer equipment as Class A or Class B, and wonders how they relate to practical considerations in the ham shack. Dick has an old TRS-80 which is "horrendous" on the HF bands, and which makes him edgy to lay out "big bucks" for a more modern machine.

Well, Dick, in general the FCC guidelines are probably the best thing you've got going for you. Some time back we covered the specifics, and I'll go through it again if a bunch of you want me to, but the long and short of it is that the guidelines for FCC Class B are at least much better than Class A in reducing unwanted emissions. This means a lot if you are trying to pull the weak one out of the mud. Class B computers are the only ones certified for home use. So, if someone tries to sell you a Class A computer, or worse yet, an uncertified computer, just say no. Sorry, but that kind of tsoris *[trouble, distress, woe, or misery, according to* Webster's New World Dictionary*—eds]*, you don't need.

We'll cover more of this craziness next month, and try to respond to some of the things you have asked about. I especially appreciate the comments, questions, and suggestions regarding simple little devices and circuits of use to the RTTY-o-phile. Some of the best of them may well be gracing a future "RTTY Loop." In the meantime, keep them coming by mail, to the above address, or on Delphi (username MARCWA3AJR) or CompuServe (ppn 75036,2501). Graphics as PCX, TIF, or GIF files are welcome as well.

Homing In

Continued from page 59

repeater automatically pages LPSAR hams. At the same time, it dials into N6ZKJ's computer, reports the time and strength of the ELT signal, and sends a sample of its audio.

LPSAR has added three other remote ELT/EPIRB monitors, including one on the CAP repeater atop Santa Ynez peak. The Santa Ynez repeater has automatic paging, while the other two are tied to the computer via landline. The computer keeps careful records of all alarms, and facilitates comparison of the signals from the remote sites to pinpoint the signal source. Says N6ZKJ, "This SAR team takes each ELT signal seriously."

The next logical step would be remotely-operated 121.5 MHz direction finding equipment at the receiver sites, right? The Santa Barbara hams have already of thought of it, of course. But it's tricky. Sensitive RDF sets with switching antennas usually do not perform well next to high power transmitters at typical radio relay sites. Despite the technical problems, they are making progress, and I hope to be able to report success in a future "Homing In" column.

Pioneer Hams

The Santa Barbara remote alerting system has been so successful that it has become the prototype for a nationwide network, with L-Tronics as the prime contractor. Sixty-four ELT monitors are now in place at airports in 38 states, with more in the planning stages. Each unit dials a computer at the FCC in Washington and sends data when it hears an ELT or EPIRB. Who says we hams don't make technical innovations any more?

There is lots more to tell about the good work of LPSAR, but it will have to wait until another time. Meanwhile, hats off to Lou and others around the country who use their T-hunt talents for this important public service.

And thanks to everyone who wrote in about SAR RDF. Keep the cards and letters coming, and find out how you can help fill the SAR needs in your area.

As W4DZA put it: "There is nothing quite like the thrill of hearing someone say on the radio, 'The chopper/ground search team is on the way to base with a survivor,' and to know that you played a part in possibly saving a life."

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Never Say Die

Continued from page 4

glee over your latest choice of directors—most of whom you let run completely unopposed. Wow, talk about apathy!

Bigotry 1991

Yes, I know we're not supposed to talk about race, politics and religion over the air. Heck, people get holy hell just for writing about it. These are areas where few people are able to think and most just react. . . usually negatively. Hate.

We can cover it over if you prefer, but the fact is that I'm hearing more racial slurs over the air these days than I can ever remember in the past. I'm not talking about racial jokes, no matter how tasteless. Alas, we seem to have built up a sensitivity to even the slightest hint of a slur against a race or group. I wonder if Randy Newman's "Short People" would even get played on the radio these days?

Comedians are having a terrible time. They can't joke about blacks, Jews, Catholics, women, gays, cripples, lawyers, doctors, morons, drunks, drug addicts, Italians, Poles, Arabs, Mexicans. . . without being accused of being insensitive. Andrew Dice Clay is a natural result of this oversensitivity syndrome. This is why he is able to convulse audiences.

This is also why, I suspect, we're hearing so much insensitivity over the air. Oh, some of it is the Archie Bunker mentality sounding off, but much of it is just hams fed up with sensitivity and wanting to stir things up. Old-timers will remember W2OY, who made a career of angering anyone who's goat was on a short tether.

As a rich, conservative American WASP, I'm a ripe target for almost every group to hate. I'm white, so most blacks hate me automatically. Hispanics too. You can imagine how long I'd last in Baghdad today. Or Tehran. Even in Paris it's safer to wear a Canadian maple leaf. You don't get treated quite as lousily.

The poor hate me for being successful. They're not willing to put in the work I have, so they can only hate me for having worked so hard for so many years.

The Muslims hate me for coming from a Christian country. . . and never mind my own religion. Let's kill him, just to make sure.

The Chinese hate me for being an American, being white and being a capitalist. Think I'll just stay away from China for a while. Since as a country (with the exception of Bush) we're mad at China for killing all those students, it's safe to make fun of the Chinese. And the Iranians. No one is going to accuse us of insensitivity if we dump on Iranians, right? Or Iraquis. Seems like rather fickle sensitivity to me, but then perhaps I'm oversensitive to sensitivity.

Was it unfair that the Bush team beat Dukakis over the head with Willie Horton? Was that insensitive? Or was that a fair attack on a governor who let his liberal political beliefs blind him to the danger to society he was turning loose?

When I was young I never had any reason to fear going anywhere in New York City. Blacks and Hispanics were just other people. Now, together with every other white person in New York, when I see a group of blacks coming along the street or in a subway car, I'm afraid. I know I'm at their mercy and that no one is going to take a chance with their lives to help me. The blacks know they can do anything they want. Is it bigotry that is involved, or the knowledge that the overwhelming percentage of crime in New York is black instigated? I believe in those odds and stay away from New York as much as possible to keep them low. One of the best moves of my life was to New Hampshire almost 30 years ago. . . after having lived in New York for 30 years on and off.

Amateur radio in America is a white hobby. We may have 13% blacks by population, but I'd put the black ham population at well under 1%. Should we feel guilty about this and make a big effort to recruit black hams? Should we start pushing for more Hispanic hams? More women? More gay hams? Ha, gotcha that time. . . I know you don't want more gays. I made a lot of enemies when I wrote an editorial explaining that sexual preference seems to be programmed in genetically, so give 'em a break. Whew, did I get a bunch of hate mail on that one!

I explained last month that men and women have a great deal of difficulty talking. . . not just over the air, but to each other anywhere. The two sexes are so basically different in goals that communication between them, even in marriage, is a major problem.

With men it's macho on the line all the time. With women it's a need to be loved. Men basically don't need to be loved, they want to conquer. I know I should write the whole book on this instead of presenting it in shorthand in order to head off hairsplitting emotional arguments, but that's what we're up against. . . and one of the major reasons why we have so few women on our bands.

Men constantly try to one-up each other in contests, pile-ups, certificate hunting, broadcasting bulletins. . . and in being outrageous on the air. The worse we are on the air, the more we are trying to cover up our own inferiority feelings. And, feeling inferior, obviously we'll put down anyone who is different. . . by race, accent, color, sex, size, religion, politics. Where is W2OY when we need him. . . to help blast those moronic, short, fat, black lesbians off 14.313?

Perhaps the FCC will recognize the terrible social travesty here and insist on affirmative action, stopping any more whites from getting ham tickets until we're up to 13% black. It would be insensitive to do anything else, right? How do we have the right to all these public radio frequencies when we have remained firmly unintegrated?

Will blacks demand a lowering of the technical barriers on the basis that they are unfair and have been keeping them out? This is what has been happening in other similar cases. If the blacks can't make it, we lower the barrier. . . but just for blacks.

Then we'll certainly hear from the women, demanding a further halt on men being licensed until we're up to 50% women. And what can we reply when they charge that a small, exclusive old white man's private club has been unfairly given use of hundreds of billions of dollars of government property?

What percentage of Hispanics will affirmative action force us to recruit? American Indians? Koreans? Cambodians? That's crazy, they wouldn't dare mess with our small, private men's club—would they?

Mad yet? Well, I'll try harder next month. H.L. Mencken wrote, "A sense of humor always withers in the presence of the messianic delusion, like justice and truth in front of patriotic passion."

And The Winner Is. . .

We had two big winners recently which were financed by the bountiful ARRL coffers. These seemingly bottomless money pits, enthusiastically funded by the ham industry and a docile membership, made big winners out of the ARRL's law firm, even though it went down to a totally predictable defeat in the really dumb effort to fight the FCC in court over their 220 MHz decision.

The FCC, not liking to be sued, particularly where such a big cover-up of political influence was involved, has thus been even further estranged as an ally to amateur radio. Talk about biting the hand that feeds us! It's like kicking the judge on your case in the crotch out in the parking lot just before you go on trial.

The other big winners of the month were the ARRL directors, most of whom ran unopposed (again), and are thus back at the old Newington feeding trough, gleefully dividing up their share of your (and industry) yearly donations.

It's no wonder the directors have such a low opinion of the membership and talk of them as mindless sheep they can manipulate in any way they want. It's a terrible thing to consider, but perhaps they're absolutely right! The 1990 election, if we can dignify the travesty with that name, would seem proof positive that the membership could care less what happens to amateur radio.

Yes, I see those furtive looks and sense your surliness. I'm saying, "Bad dog," and you're feeling guilty and a bit defensive over the mess you've made. The guiltiest of all are the Rocky Mountain members who allowed Marshall Quiat to run completely unopposed. I couldn't believe it! I wouldn't have been any more surprised if they'd run good old Charles Keating for the job! Or Saddam Hussein. Obviously there is no sense of shame in Denver. . . maybe something to do with Bronco guilt, I don't know.

Oh sure, go ahead and get mad at me. Sure, shoot the messenger, but whatever you do, don't read the message. Hey, when things are going good, I'm a great cheering section. But when they're bad, I'm not going to be part of the cover-up. I tell it as I see it and I have a discouraging record of being right. If you bet with me you'll usually win. If you bet against, you're looking to lose. And if you think that's old Uncle Wayne's ego again, start reading my old editorials and see how often I've been wrong in my predictions.

Now, when half of the directors come up for reelection this year, will half the membership go blind and dumb again? Or are you going to start looking around for someone to run against the incumbents? We need some new scoundrels in there at the ARRL trough.

Oh yes, there was a rumor going around at Christmas that President Price would be replaced at the January director's meeting. It was a nice Christmas present, even if it turns out to be a bum steer. Maybe they'll elect Quiat. Why not expect the worst and then be pleasantly surprised if the disaster comes short of it?

Prodigy

My wife (Sherry) is up to here in Macintoshes. Fortunately we live in an area of the country where there are more computer experts per square mile than Silicon Valley, so she's had plenty of help getting her Macs going.

She uses 'em mostly for desktop publishing to support the one hundred how-to-dance videos she's produced (so far). But she also gets trapped by computer games. Then came Prodigy, with its local phone number. Now her Mac is connected to the BBS for hours a day.

As much fun as RTTY was while I was involved, I sensed that I had to cut the cord. It just gobbled up too much time. I'd get typing away to friends on RTTY and the next thing I'd know it would be 4 a.m. That wasn't the way I wanted to spend my life.

When BBSs came along I tried one and found myself in the same quicksand. Whoa, boy! Yeah, it's fun to sit and chat. But it doesn't do much toward helping me to accomplish my goals. Of course, if you don't have any goals other than marking time until you die, a BBS can be a great way to get rid of large gobs of time.

Prodigy is the BBS the users love to hate. It's slow, expensive, your stuff is censored by dictatorial morons, you can only send short messages, and it sure isn't user-friendly. Fax communications beats it all hollow for my money.

On the positive side, I found some old friends there. Alas, I found the need to keep messages short. There's no way to discuss ideas intelligently in a few paragraphs. Using Prodigy is more like conducting a chess game by mail.

You can leave messages for me on Prodigy at JJMK68B. . . or fax (603) 525-4423. . . or by mail in Hancock NH 03449. I'll get 'em all. Please don't (do not) phone. I hate the telephone. Also, I travel, so don't expect quick answers. For instance, in January I was in town the 8th, 15th, 16th, 24th, and 25th. With 16 current publications (all requiring lengthy editorials), two new ones

starting that month, and four more in the works. I had more to do than get back to "How are you?" BBS messages.

How am I? Don't ask. I already covered that a few months back in detail. I'm fine, thank you. Having been dieting lately, I'm even less tolerant of fools and their blather about no-code than usual. Not one single new argument, pro or con, has surfaced in the 32 years I've been championing a no-code license. Phooey.

Getting back to BBSs, I prefer to spend my time reading (for my education), writing (to educate others) and getting things done toward my goals in the music, educational, publishing and ham fields. All work? Nah. I do get out skiing, diving, watch some TV, catch a few movies, see some plays, and go to some concerts. Not bad for living in the mountains of New Hampshire, eh?

Old-timers have followed me from the *73* start in October 1960 in a little two-room office over a Brooklyn grocery store. Even older-timers remind me of my first ham magazine back in 1951, which I started from Cleveland, Ohio, while working as a TV director.

I've been giving advice for most of these 40 years. A few people have taken it and done well . . . getting into the hundreds of millions. Some have ignored it and lost . . . some have even lost billions ignoring my advice. I don't think anyone has ever lost by paying attention to my predictions.

Negative Vibes

Does your faith in amateur radio have the vitality to face unpleasant truths about your hobby? Or do you prefer the usual whitewash, everything-is-actually-peachy approach in your reading?

I get a few letters grumbling about my gloom and doom observations. It seems to escape these negative-oriented folk (of which we have a seemingly endless supply in amateur radio) that my glooms are always accompanied by creative, constructive solutions to our problems. I believe in facing our problems and solving them. That's the only way they're going to go away. I'm solution-oriented. How about you?

On a recent skiing trip to northern Vermont I finally had enough time to myself to get some work done. First, I planned a complete reorganization of the reporting system for the many projects I've got going.

Then I caught up with a cubit stack of magazines I'd brought along. I like to keep up with technology. I never know when I'll run across something which I can use. So I read *Scientific American*, *Omni*, *Discover*, *Fortune*, *Success*, *Technology Review*, *Kappan*, *Inc.*, etc., marking ideas of value as I go.

The magazines read, I turned to a stack of books. I always take along more than I can possibly read. The last time I went on a reading binge like this was a year ago when I was on a scuba diving cruise with Chuck KO1I. We dove all day and I read the rest of the time. This time I skied most of the day and read the rest of the time.

Now there you go, being negative again, grousing about old Wayne wandering off about this and that. Yes, I do, it's one of my few charms. But wait'll you find out what I lucked into, bookwise! One of 'em explained a lot to me . . . and you should find it interesting, too.

The book was "How to Work the Competition into the Ground and Have Fun Doing It," by John Molloy, the chap who wrote "Dress for Success" and "Live for Success," both of which I enjoyed. This little old $10 paperback was great! Full of ideas.

But the part that was of the most interest to me had to do with creativity. I'm always interested in this subject and how it can be taught. Well, John does a lot of consulting and one of his projects was to try and find out how creative people differ from others. And why.

Being an almost pathologically creative person . . . it's more of a curse than a gift . . . I wanted to find out how this happened to me. John interviewed a bunch of outstandingly creative people, trying to find out what they had in common. His findings were surprising . . . and discouraging.

I found them discouraging because I was hoping creativity might be more teachable. Entrepreneurs need creativity in heaps to surmount the constant flow of serious problems they face. America needs creativity if it's going to regain its lost high tech industries. We're famous for inventing new technologies and then watching the Japanese develop the practical applications, running creative circles around us.

We invented tape recording, and they smothered us in innovative tape recorders. We invented digital watches, and they buried us in innovative watches. We're desperately hurting for creativity in our industrial research labs.

Look at how we're hurting in amateur radio for the lack of creativity. We should be years ahead of where we are in spread spectrum development, in high speed digital communications . . . including not only words, but graphics and music. We've deplorably let our hobby and our country down. We're far busier fighting over that antique communications curiosity, the Morse code, than in trying to move ahead. Morse is fun, but it's about as relevant to communications today as the cat's whisker and a chunk of galena. It's for people who are holding desperately onto the past because they have no vision of the future.

I couldn't help but take another swipe at the old-timers who have dedicated their lives to trying to bury amateur radio . . . along with themselves.

Now, back to what John found out about creativity. We're talking creativity in business and engineering, not artists and poets. First, he found that creative people tended to be highly intelligent. Second, they were hard and effective workers. John says, "In fact many work all the time. They never turn off. They take their work with them wherever they go." Hmmm, that sounds familiar! Hey, that's me, with my laptop computer in the back seat of my van.

"They create by bringing order to seeming disorder. They're always thinking, rethinking, reviewing, and reordering." It's the old 5% inspiration and 95% perspiration formula espoused by Edison.

The third characteristic of creative people is a positive attitude. Oh, they are as aware of the problems as anyone, but they're optimistic about them. When I get a letter from a reader saying he doesn't always agree with my editorials, I know he's not a creative person. A creative person reads my editorials and comes up with even better solutions to problems. He just doesn't think in negative terms.

When I get a really negative letter I feel sorry for the writer. I know he's that way about everything and with everyone. He isn't selecting me to dump on, I'm just one more. What a horrible person to have to work or live with!

Molloy found that creative people were loners as children. They tend to march to their own drum and to heck with conformity. "Pragmatic nonconformists," Molloy calls 'em. Most still dress the way they want and don't care what others think. As kids they didn't have many friends . . . didn't need 'em.

I tried smoking and didn't like it, so I never smoked. I tried drinking while I was in the Navy. When I noticed that alcohol made me stupid, I stopped. I tried pot and LSD a couple times. Nope, not for me. I tested those drugs and decided conformity wasn't worth it to me.

Creative people love solving problems. Maybe that's why I can't pass up a crossword puzzle or a cryptogram. And I truly enjoy helping people solve problems. That's why I read over a hundred magazines a month and books by the dozen . . . I get Ideas from them which eventually click into place to help solve a problem. I enjoy mentoring college students.

Well, hooray for me. Yeah, I suppose. But understanding that negativeness prevents people from being creative is worth understanding . . particularly if you are an employer . . or if you're looking for breakthroughs in amateur radio. Employers need creative problem solvers, not negative thinkers. And they get hard workers as a bonus.

With the future obviously going electronic, we need all of the creative people we can find. And we need to attract 'em to amateur radio, where they'll be able to help both us and our country. If we let the Morse coders keep us In the 1930s, we're signing a death warrant for the hobby . . . and we could be helping to consign our country to second place . . . or even third, behind Europe.

Yes, I know all about the new no-code Tech thing. I also hear the old-timers' necks creaking as they warn of dire consequences. Meanwhile, the ham industry—in a burst of euphoria—is again expecting the money tree to start growing. Like when we got Novice Enhancement. Remember that beaut?

Being pragmatic, I warned that all we'd done is remove a small roadblock. We still hadn't put up any road signs. The no-code deal is another block gone. We still have to go out and advertise or the kids aren't going to even know our road exists. Has the industry learned yet? Are you kidding?

I'll be reading every ham club newsletter I can get to see if one ham club anywhere has come up with a positive program to promote the hobby to kids and get the parade started.

If I Asked You . . .

Suppose we're having a contact and I asked you to tell me about a time when you really had a lot of fun with amateur radio. What would you tell me? A question like that could keep me going for days. How about you? I don't suppose there's any chance you'd take a few minutes and write, since I haven't run into you on the air recently?

Ham radio has provided me with a couple lifetimes of fun. That's one of the main reasons I got snookered into publishing *73*. It's got something to do with wanting to share the things I've enjoyed with as many people as possible. In my *CD Review* magazine I'm having fun introducing the readers to music they might otherwise have missed.

When I got out of the Navy after World Misunderstanding II, it didn't take me long to build an all-band (813 s) kilowatt rig. Then I lucked into a beaut of a 75m kilowatt rig (203Zs). I had two complete kW stations, one with an SX-28 Hallicrafters receiver, the other with a National 100A.

I had my ham shack set up in the basement of my fraternity house at college, with antennas all over the place. The fun was to get into a round table on 75m and then go down to 20m and make a DX contact and rebroadcast his signal on 75m to the round table. In this way we were able to work African, European and Asian DX stations into our round table. The net could hear the DX chap through my 75m rig and he could hear the net through my 20m rig. That was a ball!

Yes, of course I got a pink ticket from an FCC monitoring station. I just sent 'em a copy of the letter I'd gotten from the FCC in Washington saying this kind of operation was legal. Didn't hear any more.

So tell me about some of the exciting things you've done. If you get me excited too, I might share your story with the *73* readers . . . or in a publication to help get Novices more involved with the hobby. Remember, when you're a silent key, about all that will live on after you is what you get published.

And it's really fun when your friends read your stories and feel they know someone famous. Or when someone you contact on the air has read your stories and recognizes your call.

I can handle anything I can read, from old notebook paper to a computer printout, but of course It's easiest for me if you include a floppy disk. 73

HAMSATS

Amateur Radio Via Satellite

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STS-35: Mission Accomplished!

It's been over seven years since the first ham-in-space activity by Owen Garriott W5LFL from the space shuttle *Columbia*. Since then, others have gone into orbit with amateur radio gear. Callsigns like WØORE, DPØSL and U2MIR have been heard from orbit. Now WA4SIR joins the ranks of the ham-in-space fraternity. His efforts from STS-35 were quite popular and very successful.

Columbia blasted skyward on December 2, 1990, in a spectacular nighttime launch carrying the Astro-1 telescope mission and Ron Parise WA4SIR with his ham radio gear.

The $150 million Astro STS-35 mission carried four advanced imaging systems. The broadband X-ray telescope, designed to be pointed by ground controllers, worked well. It succeeded in sensing much cosmic phenomena not visible from the Earth's surface due to the absorbing characteristics of the atmosphere.

The other three telescopes, aimed at their targets by computers in the shuttle, were designed to receive ultraviolet radiation. On the first day of the mission, one of the telescope-steering computers failed. Four days later, the second one went down. The systems were located in the shuttle rear-deck area. Ground crews and the flight team found the situation difficult, but not insurmountable, as controllers on Earth radioed target coordinates verbally to the astronauts, who used joysticks and TV cameras to aim the telescopes manually.

SAREX-II Successful

The Shuttle Amateur Radio EXperiment went much smoother than the telescope operations, but not without a few problems. On the positive side, 238 stations around the world managed to make complete two-way packet contacts with the WA4SIR ROBOT terminal node controller (TNC). Signals from the shuttle could be heard on 145.55 MHz FM. The corresponding uplink was 144.95 MHz. Note Table 1 for a comprehensive list of those logged as complete contacts.

A few stations even had two-way voice contacts with the shuttle. Several hundred more packet stations were heard by the SAREX-II system and received unique QSO serial numbers. However, they weren't able to complete a verified two-way exchange. Thousands of stations attempted to contact Ron without success, but it was educational and even entertaining just listening to the voice activity or watching the packets flash past as *Columbia* flew overhead. Table 2 is a sample of a SAREX-II bulletin sent on the second day of the mission, plus some other bits and pieces of packets received as the shuttle sped around the world.

Not all of the shuttle activity used the published 145.55 MHz downlink frequency. Conversations could be heard on nearby frequencies during many evening passes when the shuttle was within range of the Johnson Space Center in Houston, Texas, or the Goddard Space Center in Greenbelt, Maryland. Several phone patches were made for the astronauts with their families.

Although many hams were probably listening in, interference was rare and the conversations, at least from the shuttle side, could be monitored on small home systems or even HTs.

If you are on the gold-star QSL list in Table 1, or if you made it to the silver-star QRZ list (published by AMSAT), send your QSL to the ARRL, 225 Main Street, Newington CT 06111, Attention: Education Activities Department. A silver-star contact means that the robot heard your call but could not complete a two-way acknowledgment. QSLs are also available for SWL reports. Those few stations that had the pleasure of a two-way voice QSO will be eligible for the top-grade QSL reply.

An important part of Ron's activity from orbit involved schools around the U.S. Although the shuttle was not in view over the U.S. during school hours, methods were devised to connect Ron to a phone network via hams in areas of the world that had direct 2 meter access to the shuttle. Stations in Australia, including VK2AS, VK5AGR, and VK6IU, provided access during passes over their coverage areas while PY2BJO did the same from his location in Brazil.

Questions were uplinked to Ron via this system. Ron would answer the questions, many times adding commentary about the view from above, and giving updates on the Astro-1 experiments. While only a few schools were involved with direct communications with the shuttle, many others were online, listening. AMSAT and ARRL representatives were pleased with the results, considering the complexity of the arrangement.

Lessons Learned

There were many comments from the Monday-morning-quarterback point of view about the STS-35 SAREX-II operation. The ham-in-space activity was extremely successful. Not all hams made contact with the shuttle, but everyone who tried, should at least have heard Ron or the robot. Much of the difficulty in working the shuttle was caused by vehicle attitude, operator schedule, interference, and system limitations.

During the flight of STS-35, the shuttle had to align itself for telescope observations. Since the 2 meter antenna was located in either the pilot's or commander's window, much of the time it was aimed away from the earth, or, due to its directivity, it was aimed at only a portion of its potential coverage area. Because of the vehicle's orientation, not even an antenna in the cargo bay would have cured the problem on this flight, but it could help considerably on future missions.

Because of phone patches and private conversations, the packet system was not active on many passes over the U.S. If a second radio operating on 70cm could be employed for private voice activity, the packet system could be operated full-time on 2 meters. But the amateur radio experiment isn't a paying customer, and it's difficult to justify the inclusion of more ham equipment just to simplify packet connects to an orbiting robot system.

Congestion QRM

For hams in remote locations around the world, it was relatively easy to make a complete packet contact with the shuttle. In the U.S., the situation was quite different. With as many as a few thousand stations all sending packets on the primary uplink frequency of 144.95 MHz, it is likely the SAREX receiver was in a state of constant overload. The 60 stations in the continental U.S. that actually completed a full two-way contact with the robot were either running a lot of power at just the right time, or were incredibly lucky, or both. Also, many uninformed hams could be heard calling before the shuttle was above the horizon, after it was long gone or even on the wrong frequency.

Fortunately, the shuttle activity on 144.95 MHz caused little disruption of the DX packet cluster using that frequency for terrestrial DX information forwarding. If the shuttle activity had occurred during a DX contest weekend, there could have been significant disruption of packet clusters.

Since Owen Garriott's flight, congestion on 2 meters has increased. Ham-in-space SAREX operation has been infrequent and of short duration, but it will require more coordination when ham activity from a U.S. space station becomes a reality.

The robot could only support nine simultaneous connects in progress at any time. During a typical successful robot QSO, an Earthbound station sent a connect request skyward. The robot received it and sent an acknowledgment with QSO serial number establishing the complete connect. The Earth station then sent an ACK back to the robot which, upon receipt, logged the Earth station's call in the QSL list and initiated a disconnect packet.

Unfortunately, due to heavy crowding on the uplink, many stations could not get their ACK back to the shuttle after the connection had been established. The robot continued to hold their callsigns until the connection timed out, thus making it impossible for others, beyond the nine connected stations, to get in. Only 13 percent of those stations who managed to initiate contact with the robot completed the two-way exchange.

Table 1. Two-Way Packet Contacts with WA4SIR

QSO ####	CALL	QSO ####	CALL	QSO ####	CALL	QSO ####	CALL
1	WP4XO	377	KH6GPI	811	KH6GMP	1211	VK6ABY
5	VK5ZAH	412	XF3RC	833	WAØD	1213	VK6CC
6	VK3DBO	429	W1YRM	846	ZS6TVB	1214	VK6PH
7	VK5AGR	430	N3EMA	848	ZR6AGA	1218	VK5QX
9	VK3ZBB	445	N5BCA	849	ZS6SM	1219	VK5AVQ
11	VK2ZW	448	N5ITU	867	WW7B	1220	VK3YJM
35	W2DTC	463	YV1CP	881	XE2M	1229	VK4ZGF
40	NZ3F	467	ZS1CA	883	KA5CDJ	1246	N6DGK
48	VK6MJ	469	ZS4BU	885	XF3PP	1251	WB5NLY
49	VK6YJS	481	KH2A	891	XF3RA	1256	XE3RY
52	VK5ZK	484	JR1AHQ	892	XE3YE	1260	KP4EKG
54	VK4ZF	497	ZS6BTD	893	XF3AFU	1262	WP4G
55	ZS6IT	499	ZS6AQF	897	XE3XE	1280	NH6UY
59	AH6IX	507	JR3FRF	906	ZR4AAD	1262	WB6W
61	NH6OU	522	OA4AGM	915	KJ9S	1288	KI6OE
65	KH6H	530	JA9TQK	922	JR5EBL	1293	NW7N
67	WB6LLO	534	JH1OMA	924	JR1EDE	1308	N4PLY
68	N6JLS	546	EA8BRV	925	JH2NIT	1311	WD4SBV
69	N8KN	549	VK6ZZ	928	HC8VB	1312	K9ES
70	KJ6AW	550	VK6DM	929	HC5K	1314	K4OSM
71	N6WHO	552	VK6VX	930	PT2WWV	1320	KP4PX
72	NK6K	555	VK5ZTY	932	PT2AR	1324	YV5FSF
94	KA5SIG	559	VK3EEE	936	PY2EML	1327	YV5FSH
112	ZS6BBY	579	WYØH	937	PT2SC	1328	ZS1KT
117	N6ZAY	580	WH6AMX	951	JA3XCZ	1331	ZS6AWK
160	ZS6HS	613	N8DEU	961	JA3ZDJ	1365	PT2TD
174	WA6LIE	616	XF3R	962	JA6FTL	1367	PY6ASV
177	KE7NR	620	XF3RD	963	JK3RLO	1368	PT2ON
178	N6RVC	630	9Y4DG	986	4X4LF	1376	ZS6BNT
180	WA5PIE	635	ZS5NZ	988	KEØSC	1383	Z21GH
185	XE3EB	639	AH6IO	993	VK1AU	1393	JA1ESP
191	ZS6AKV	648	WA6YFD	1003	NP4BM	1395	JN1BWP
194	ZS6BMN	651	K6OYY	1011	ZS6AJS	1402	ZS1JY
195	3DAØAY	658	KA6UCD	1052	KB4ODE	1412	JH2AYB
199	VS6VU	666	KC5FP	1060	YV4ABC	1441	PU2NPQ
201	JH7CKF	667	N5QWC	1072	ZS5J	1442	ZY5AAT
204	JH3EXG	675	XF3OZ	1076	KA6NEI	1446	PY2NPP
209	OA4CK	676	XE1MMD	1083	NH6HF	1457	N6ZND
213	JH3FDA	679	XE1LM	1105	XE1PM	1466	WA2KDL
216	JP3QJJ	709	OA4HV	1116	HK4BHA	1472	N6MEL
218	JA1YZM	711	PY2GN	1122	ZS6BZE	1482	AA5GA
220	JA1ANG	712	PY2MSG	1125	ZS6XL	1486	W5IU
226	LU8DYF	713	PY2EXD	1136	JJ2RYW	1489	W5OJ
231	ZS6CA	718	ZS6AQC	1138	KJ9U	1511	KP4YD
247	VK3DTO	725	FR4FM	1143	XE1IX	1524	ZS6BSE
258	N6UEA	726	JR4BRS	1145	XE1RK	1550	JH2GEC
268	W7US	729	JH1LVN	1146	XE1LCE	1563	LU9DO
273	N5LCO	741	JA4BLC	1151	HC5AH	1570	FO5LQ
295	VK2RX	743	JA2BGX	1160	Z21FB	1599	KP4ECL
296	VK2BXQ	748	JJ1WTK	1169	JJ6AGL	1616	KA5OTB
305	VK6LI	750	JR1RBR	1171	JJ6AGM	1622	KG5ND
310	VK6YBP	760	JA2UGV	1175	JJ6AGN	1639	HK5BVD
314	VK5AKK	762	JP3QJK	1177	JJ6AGK	1657	ZS1SAT
316	VK4AGL	763	JN1GKZ	1184	AH6GR	1658	ZR1L
347	W5BKK	774	WD6DRI	1190	JA3YEO	1662	ZR5TT
364	WP4CNU	782	WOØP	1192	JM3WYI	1668	KE2FB
365	8P6SM	791	KG3N	1193	JR8XPV	1678	VU2LBW
371	KG6DX	796	K4GMP	1206	LU1EXC	1701	JR3YEO
372	KH2D	801	KP4BJD	1208	VK6BMD		
379	WA6EMV	808	9Y4NC	1210	VK6YBO		

Table 2. Sample of Packets Received from SAREX-II, STS-35

WA4SIR > QST:The SAREX Robot is a SPLIT FREQUENCY operation and is NOT receiving on this frequency. WA4SIR is listening for connect requests on one of the following frequencies: 144.95 (primary),144.91, or 144.97 MHz.
We are now in our first day of operations
WA4SIR > QST:with most things going well.
The Instrument Pointing System has delayed experiment operations at this point but we are working on it. Have fun working the robot and stay tuned for more information!
73's Ron, WA4SIRWA4SIR > NK6K:#17-is your SAREX OSO number.
Thanks for the connect from the Space Shuttle Columbia.
....
WA4SIR > N5LCO:#273-is your SAREX OSO number.
Thanks for the connect from the Space Shuttle Columbia.
....
WA4SIR > QRZ:#1202-KE7NR WA6AZP N6UEA N6NJI N6DGK WA0QII N6PSU N6RW N6WJP WB6LLO VK4AOR VK4BKW VK4ZGF VK2AAB VK2KJU VK4BCK VK2AS VK2PA VK2DFY VK3FRS VK2BXQ VK5QR VK5ZFM WA4SIR VK1ZZT VK3YJM VK5AVQ VK5QX VK5PO VK6DM VK6PH VK6CC VK6UU VK6ABY VK6YBQ WA4SIR > SAREX:Connect to WA4SIR for a SAREX Robot OSO with the Space Shuttle Columbia.
WA4SIR > N5ITU:#1300-is your SAREX OSO number.
Thanks for the connect from the Space Shuttle Columbia.
WA4SIR > QSL:NW7N/1293 KI6QE/1288 WB6W/1282 NH6UY/1280 KP4EKG/1260WP4G/1262 XE3RY/1256 WB5NLY/1251 N6DGK/1246 VK4ZGF/1229 VK3YJM/1220 VK5AVQ/1219 VK5QX/1218 VK6CC/1213 VK6PH/1214

What's Next?

The Soviet space station *MIR* has been active on 145.55 MHz FM simplex for quite some time. Musa U2MIR (UV3AM at home in Moscow) has been heard many times between 1200 and 1300 UTC. Mission Commander Victor U9MIR may also be on the air as time permits.

QSLs for current *MIR* contacts should be sent to: UA6HZ, Valery Agabekov, Box 1, 375600 Yessentuki, USSR.

Packet operation may begin this spring when the equipment can be sent up on a Soviet *Progress* launcher. The packet radio experiment acronym is AREMIR, for Austrian Amateur Radio Experiment on MIR, and consists of a TNC-2 and 2 meter HT built into a "black box" with connectors for the antenna and a laptop computer. Launch is anticipated in mid-March after some slips due to delays in final AREMIR checkout.

For the first few months AREMIR will operate in the beacon mode. Later, a laptop will be sent to *MIR* so the cosmonauts can enter messages. There is currently some concern about whether the laptop will survive environmental testing. It may not arrive at *MIR* until September or October, when the Austrian cosmonaut is scheduled to go to the space station.

STS-37 is currently scheduled to take off in early April. ALL of the astronauts are licensed hams! They include: Ken Cameron KB5AWP, Jay Apt N5QWL, Linda Godwin N5RAX, Steve Nagel N5RAW, and Jerry Ross (waiting for a new callsign).

The system they will take to orbit is comprised of a 2 meter HT, a spare battery, an interface module, a SAREX headset assembly, an equipment assembly cabinet, a TV camera with monitor, a laptop computer, and the window-mounted antenna. The equipment cabinet houses power supplies, a slow-scan TV unit, a fast-scan TV unit, a packet TNC, and the right connectors for hooking everything up.

While voice operation requires operator attendance, the other modes can be run either with or without someone at the controls. This promises to be an exciting mission. Check the AMSAT nets and bulletins for updates. 73

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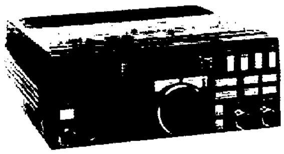

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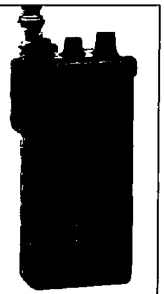

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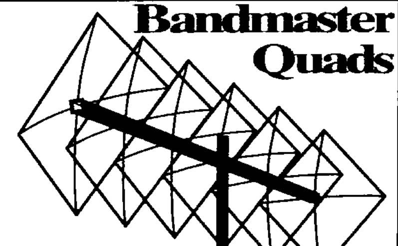
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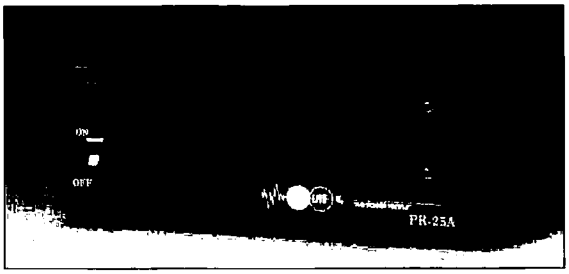


PRODUCT OF THE MONTH

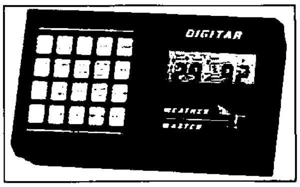
TRIPP LITE—PR-Series DC Power Supplies

Tripp Lite's new PR-Series DC power supplies are housed in a handsome dark metal cabinet that blends in with modern amateur radio and communications equipment, giving an integrated, professional appearance to any radio or electronics installation. Ideal for powering practically all types of 12 VDC equipment, the PR-Series combines good looks with exceptional performance for base or mobile radios, test equipment, and other electronic gear. Continuous-duty performance stands up to extended periods of reliable operation. These power supplies provide excellent IC voltage regulation, automatic overcurrent protection and full line-isolation.

The PR-Series DC Power Supplies are available in 3 to 60 amp sizes, with suggested retail prices starting at $38.50. For more information, contact *Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188. Telephone: (312) 329-1777; FAX (312) 644-6505.* Or Circle Reader Service No. 201.

ELECTRON PROCESSING

Electron Processing is now offering a pair of high-quality keying devices. The Green Lake paddle and key are individually handcrafted by a master machinist and designed to withstand rigors and abuse that would destroy many other paddles. They are made of solid brass on a polished brass base (bakelite on the straight key), and they come with either hand-rubbed wood handles or polished aluminum handles. The Green Lake products are priced at $90 for the keyer paddle with wood handles, $100 with aluminum; $70 for the straight key with wood handle, $75 with aluminum. The S & H charge is $5. Electron Processing is also offering a new shortwave wire antenna, the Multiwire-4. For more information contact *Electron Processing, Inc., P.O. Box 68, Cedar MI 49621; (616) 228-7020.* Or circle Reader Service No. 204.



AZIMUTH COMMUNICATIONS

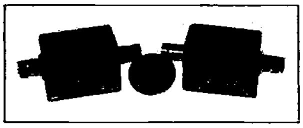
The new WeatherStar Master Weather Station ALT6 will help you monitor weather conditions with functions that give you barometric pressure (in. or mm), altitude, wind speed (MPH/KPH), wind gust record, wind direction (2 & 10 degree increments), daily and yearly rain (0.1" increments), an optional self-emptying rain gauge, inside temperature (with alarm), outside temperature (with alarm and min/max temperature record), wind chill factor, time of day (12/24 hour with alarm), and programmable scanning of functions. The ALT6 lets you set an alarm to warn of excessive wind gusts around your antennas and QTH.

The WeatherStar Master ALT6 is priced at $300, plus $7.50 for shipping. The optional self-emptying rain gauge (RG3) is $50. Contact *Azimuth Communications Corp., 3612 Alta Vista Ave., Santa Rosa CA 95409; (707) 577-8007, FAX (707) 573-1482.* Or circle Reader Service No. 206.

TIARE PUBLICATIONS

Tiare Publications has released a new *Great Radio Reads* catalog, #5. Now expanded to 20 pages, this catalog features nearly 30 Tiare books and products, as well as over 50 books and products from other publishers and manufacturers.

This new 5th edition of *Great Radio Reads* is available for $1 from *Tiare Publications, P.O. Box 493, Lake Geneva WI 53147; (414) 248-4845.* It is also enclosed free with all orders. Or circle Reader Service No. 208.



IDC COMMUNICATIONS

The WBA1500 from IDC Communications is a wideband mast-mounted RF preamplifier designed for use with wideband receivers, scanners, or even TVs and stereos, to improve performance and make up for long antenna cable runs. The WBA1500 covers 2 MHz through 1.5 GHz. A bench-type version, WBA1500B, is also available for frequency counters, oscilloscopes, spectrum analyzers, and related test equipment. The WBA1500 system comes complete with amplifier module, DC supply module, AC adapter, and BNC connectors ("F" type jacks are also available). The WBA1500 sells for $78, and the bench-top model for $57, postpaid. Contact *IDC Communications, 2745 Winnetka Ave. N., Suite 205A, New Hope MN 55427; (612) 888-7456.* Or circle Reader Service No. 205.

DELTA RESEARCH

DELTACOMM Version 1.04 from Delta Research is a state-of-the-art communication manager for the ICOM IC-R7000. Unlike similar products on the market that merely control the receiver, DELTACOMM 1.04 includes a custom MS-DOS interface for control, plus a comprehensive set of software communication tools to analyze, log and generate reports from the data. The spectrum log function can sweep a frequency spectrum at approximately 1300 channels/minute, generate a histogram, and log frequency/activity to the disk.

DELTACOMM 1.04 is priced at $300 (including external interface and components for cabling), plus $4 S & H. Contact *Delta Research, P.O. Box 13677, Wauwatosa WI 53213; (414) 353-4567.* Or circle Reader Service No. 203.

RUTLAND ARRAYS

Rutland Arrays has announced a new antenna, Model RA7-50. Model RA7-50 is a 7-element, 26'7" long, 50 MHz yagi antenna. It has a measured gain of 10.5 dB over a dipole, and matches the performance of other antennas measuring as much as 7' longer. The sidelobes have been lowered to 22 dB below the main lobe, and the F/B ratio is 30 dB at 50.2 MHz. The design features stainless steel element hardware, extruded aluminum element mounts, a T-match driven element with silver-plated, Teflon™-insulated phasing line, and 90+ MPH wind survival. A waterproof N-type coax connector is standard. For the price and more information, contact *Rutland Arrays, 1703 Warren St., New Cumberland PA 17070; (717) 774-5298 (7-10 p.m. EST).* Or circle Reader Service No. 207.

SPECTRUM INTERNATIONAL

Spectrum International is now importing and distributing a complete weather satellite receiving system, including a PC controller, from Time Step Electronics of Great Britain. Instead of using a downconverter from 1691 to 137 MHz, then feeding the signal into a 137 MHz receiver, the new 1691 MHz design uses a dedicated 1691 MHz receiver. The companion low noise GaAsFET preamplifier has increased gain and better filtering than earlier models. The new system also has a companion decoder board (IBM-PC compatible, short-slot "half-card") and software.

The 1691 MHz preamplifier is $175, the receiver is $450, and the decoder board with software is $300. For more information, contact *Spectrum International, P.O. Box 1084, Concord MA 01742; (508) 263-2145.* Or circle Reader Service No. 202.

QRP

Low Power Operation

Mike Bryce WB8VGE
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T/R Controller to Drake

Picking up where we left off last month, we'll finish up the T/R controller. This month we'll look at how to interface the controller to the popular Drake R4B and/or R4C receivers. While we're working with the Drake receivers, we'll convert them over to cover all of the WARC bands. This is a simple modification consisting of nothing more than adding a crystal and peaking the front panel controls.

Of course, you don't have to have the Drake receivers to work with the T/R controller. But the following will give you a good idea of how to connect whatever station receiver you're using. The relays specified for the T/R controller need not be used. In the photographs of the final version, I use one onboard relay and a 4PDT relay mounted off the board. This relay does most of the work in my version.

Feel free to use whatever you have lying about in the junk box. Just keep in mind the coil current that you can sink with the two switching transistors. Also, you don't have to worry about adding a diode across the off-board relay's coil, since one is mounted on the board. If you choose to go with an external relay, just connect up the two pads used for the relay coil and run wires to the coil of the external relay.

Because the case I used for the T/R controller was not high enough for the relay I chose, I had to mount it sideways. I used a small piece of copper-clad PC board and a junk box nylon mount to accomplish this. I also spent the extra dollar on a socket to hold the relay. Mounting the relay on its side made wiring to the contacts very easy.

Speaker Mount

The sidetone generator requires a speaker, which I mounted on the bottom of the chassis. A small dap of Super Glue™ holds the speaker in place. After I did this, I thought the addition of some holes to allow the sound to come out of the chassis would be a good idea.

As a second thought, the speaker could be mounted upside down with some holes in the bottom of the chassis. This might make for a good sounding tone without creating a mess on the top of the chassis. I used a small 8 ohm speaker from the junk box. Radio Shack sells one for several dollars that will work fine.

Antenna Switching

As I mentioned last month, the antenna switching is done by another relay. I used a 12-volt junk box relay rated at 10 amps. This is more than enough for QRP use. I switch +12 volts to the relay. RCA jacks provide a quick and dirty way of supplying control voltage to the antenna switch relay. The +12 volts is supplied via the T/R controller.

For maximum flexibility in connecting up different rigs and transmitters, I also used two different types of connectors, RCA and SO-239, for the antenna and receiver/transmitter. The Drake receivers use RCA jacks for antenna input, so I use a cable with RCA plugs on both ends: one to the receiver, the other to the antenna switch. The main antenna terminates with a PL-239 that plugs into the proper SO-239 socket on the antenna relay.

Mute Confusion

The last and sometimes the most confusing connection required is the mute line. In the Drake receivers, the mute line must be grounded to operate the receiver, and open to mute the receiver. This switching is all done in the T/R controller. With the T/R relay, we have a choice of selecting ground or open muting, depending on how we wire the relay's contacts. A small shielded cable connects the T/R controller to the receiver. Since the Drake mute jack also terminates with an RCA jack, a suitable cable is used, RCA to RCA. I installed RCA plugs on the back of the controller for ALL functions.

The key-in line should be connected to your keyer/computer/straight key. To activate the T/R controller, you apply a ground to the key line. Since you're not switching heavy current or high voltage, you don't need to worry about damage to the keyer. Also, in the nasty and unlikely event the home-brew transmitter you're working on decides to short out its keying transistor, and feed +12 volts back through the key line, nothing will happen to your keyer. The T/R controller fully isolates the key output from the key input.

A simple block diagram may help with the interconnection. Use this only as a guide; nothing is carved in stone!

I've never been much of a receiver builder. As was the case when I started working on the T/R controller, I never could seem to get a home-brewed receiver to work as well as a commercially built one. But I wanted a really good receiver, one that'd allow me to listen in on the WARC bands. So what I ended up with was a Drake R4B. This receiver is not new by any means. It dates back about 15 years or so when real radios glowed in the dark. Yes, the ol' Drake has tubes in it. It also has one more thing of great importance: additional tuning ranges.

By inserting the appropriate crystals in the accessory crystal sockets at the rear of the chassis, it is possible to add up to 10 additional tuning ranges. Each of these is 500 kHz wide, except for the 5.0 to 6.0 MHz band. This is the Drake's frequency for the VFO. Anything else is fair game! I installed crystals for 28.000 to 28.500 MHz, 18.068 to 18.168 MHz, 24.890 to 24.990 MHz, 10.100 to 10.150 MHz, and several for shortwave listening.

The extra crystals are installed in the rear apron of the Drake. I ordered the crystals from Jan Crystals in Florida. Just have the frequency of the rocks you need, and they'll do the rest. In a week or two you'll get the crystals. This is the type of modification I like the best. Order the crystals, install them, and start working the new bands. I made up a cheat sheet to allow quick tune-up of the new bands, because the Drake will resonate the newly installed bands under different settings than one would think. For example, the 30 meter band requires the band switch setting to be on 14 MHz, while the preselector is at the 40 meter location.

That's about all there is to getting the Drake running on the WARC bands. There's a lot of life left in those receivers, and as the old saying goes, "You can't work 'em if you can't hear 'em." 73

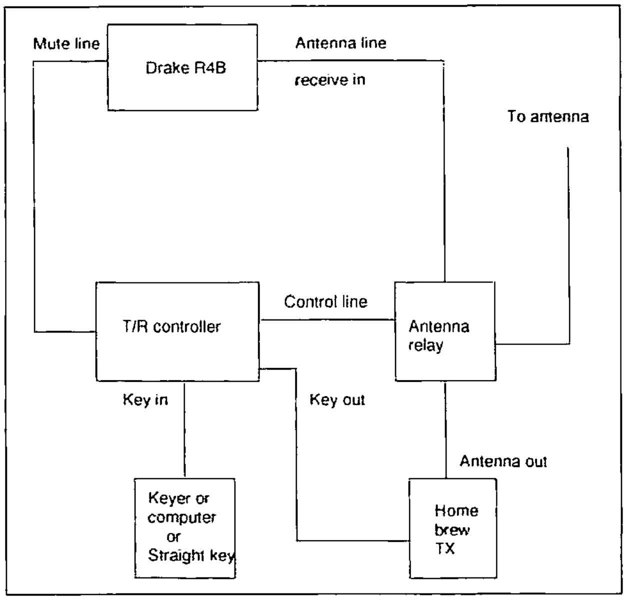

Figure. Block diagram of the interconnections for the T/R controller.

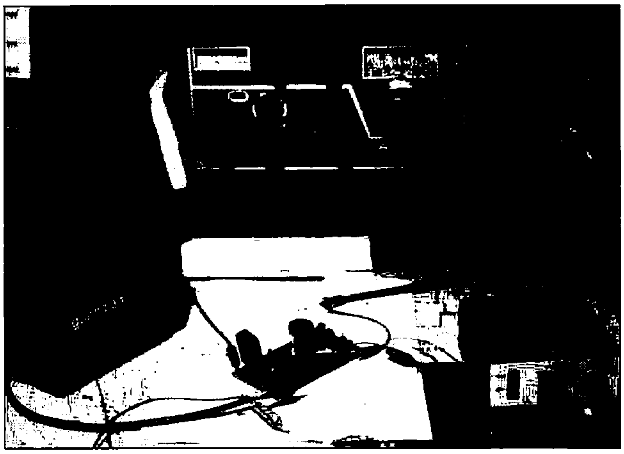

Photo A. A home-brew CW transmitter, solar-charged battery, and the Drake R4B receiver: QRP heaven!

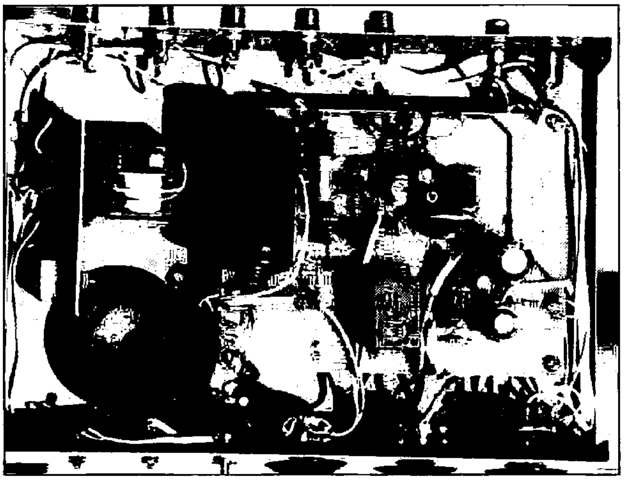

Photo B. Inside view of the T/R controller. Notice the relay mounted off of the board next to the speaker. There is one relay mounted on the board in this version of the controller.

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So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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2600/2510 OWNERS Enjoy both 10 meters *and* 12! Easy conversion, all parts and instructions, $49.95. Edward Oros, 2629 Sapling Drive, Allison Park PA 15101. BNB958

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AMIGA, MACINTOSH, ATARI XL/XE/ST Amateur radio public domain software, $4.00/disk. SASE for catalog. Specify computer! WA4EFH, Box 1646, Orange Park FL 32067-1646. BNB978

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ANTIQUE RADIOS tubes, wiring diagrams, & literature, send 2 stamps to VRS. PO Box 541 (ST), Goffstown NH 03045 for large list. BNB982

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ABOVE AND BEYOND

VHF and Above Operation

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San Diego CA 92119

Microwave Beacons

To round out last month's column on waveguide mixers and microwave formulas, this month I'll cover a typical 10 GHz microwave beacon. By changing the RF source and antenna, you can adapt the plans for this beacon to other microwave frequencies.

Unlike beacons on lower frequencies such as 6 meters, microwave beacons are not put up only to reveal current propagation conditions. If you heard a 6 meter beacon clearly, you would rush to the shack and start operating, looking for contacts on that band. But if you heard a microwave beacon from some remote location, you would, instead, get busy on the phone to set up contacts.

The microwave beacon not only alerts you to band conditions, but also serves as a piece of test equipment. During contests, the microwave beacon transmits a signal that stations can use to check antenna alignment and to prove that their stations are functioning normally. Most importantly, the microwave beacon provides a reference signal local amateurs can use as a transfer frequency standard. This way, the custodian of the beacon can verify frequency as accurately as he can (in the band, of course) and set the standard.

Frequency and Offset

In any large group, someone can come up with a best method of determining frequency either by wavemeter or frequency meter. The method used doesn't make any difference. When you have this type of system in place, all other stations can set their equipment to copy the beacon. You can set your system's frequency to either sideband mix product, offset by your IF frequency. This offset is determined by whatever IF frequency you are using. One standard is 30 MHz. For example, if the transmitter is on 10.250 GHz, you can copy on either 10.220 or 10.280 GHz, since both frequencies are in the 30 MHz offset due to the IF frequency.

When all local stations are copying the same beacon, frequency determination problems decrease. Until most amateurs in an area can agree on just where 10.250 GHz is, it can be a large stumbling block. Even if a beacon is slightly off-frequency, everyone in the local area using the beacon will be affected the same. What matters is that all stations in a local area know where the beacon is and use it.

Antenna Checking

With a microwave beacon, you can check your antenna direction pointing, and test the sensitivity of your receive system. Microwave antennas, especially dish types, can have beam widths of 3 to 4 degrees or less. This makes accurate dish aiming very important. Copying a local beacon, you can verify direction (compass bearing) and vertical position. This helps eliminate one more wobble in the system. Sensitivity can be verified by comparing results to past tests, or by placing an attenuator in the system for further tests. Use of a beacon has proved to be a valuable asset, letting you make quick assessments of system performance. Quick verification can be everything during contest weekend. See the beacon schematic in Figure 1.

The Beacon System

Construction of a 10 GHz beacon is quite simple. All you need is a source of RF, such as a Gunn oscillator, an identification system, and an antenna. The CW identification system, described in the June 1990 column, is just a simple TTL keyer with an EPROM loaded with your callsign. The unit repeats what is loaded into the EPROM over and over again, resettling after each message. The audio output from the keyer is coupled to the adjust terminal of a Gunn oscillator power supply, imposing wideband FM modulation on the Gunn oscillator.

In most beacon setups the power supply (unregulated DC) is remote to the actual beacon, with the Gunn oscillator/power supply modulator and keyer located within a common housing with the microwave antenna. The keyer is about the size of a pack of cigarettes and the Gunn oscillator is a compact structure about an inch and a half square. A short section of plastic drainage pipe is often used to house the entire system.

The Beacon Antenna

The antenna selected for beacon operation must be compact, high-gain, and omnidirectional to be of general use. What fills the bill is the near omnidirectional waveguide slot antenna. For 10 GHz, a waveguide slot antenna is less than a foot long; 6 slots (on each side of the waveguide) exhibits 10 dB gain. See Figure 3 for construction details.

The top of the antenna is shorted with a machined brass insert that closes off the top of the waveguide. A single waveguide flange connects the antenna. The Gunn oscillator may be directly connected to the antenna, or a magnetic isolator may be placed between the antenna and the Gunn oscillator. The isolator helps reduce pulling on the Gunn oscillator by allowing RF to flow freely in one direction, which provides high loss to reflected RF (VSWR).

The slots in the waveguide are vertical, in the same plane as the length of the waveguide. The radiated RF is *horizontally* polarized. To receive horizontally polarized radiation, your receive waveguide must be vertical (the longer opening of the waveguide). Having your waveguide *vertically* polarized means having the long opening of the waveguide horizontal. If this sounds confusing, just remember the rule: The

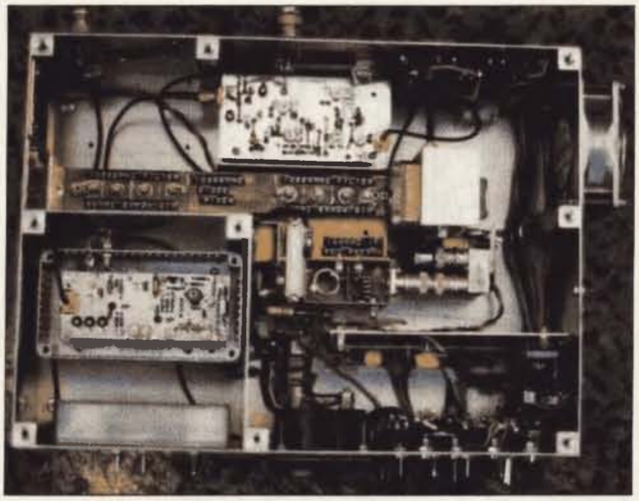


Photo B. "All mode" (CW, SSB, and NBFM) 10 GHz transverter constructed by VK2ALU. Oscillator chain and amplifier is a G4DDK design feeding a X9 SRD (step recovery diode) multiplier. The 10 GHz mixer section is a G3JVL design (image reject mixer) with output on 144 MHz.

Photo A. Lyle Patison VK2ALU of Wollongong, Australia, operating a 10368 MHz transceiver on SSB, testing over 80 km to VK2ZAC (who can receive on SSB but only transmit on NBFM). Note sighting telescope mounted below dish. A Cassegrain subreflector feed is used allowing more efficient illumination. The 20 inch dish is a searchlight reflector.

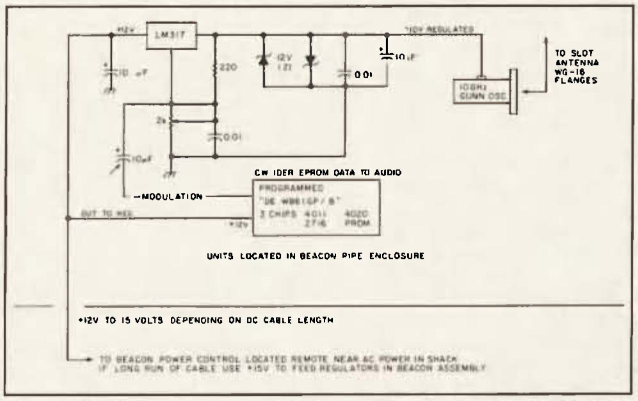


Figure 1. 10 GHz beacon showing CW ID'er and power supply. Regulator/modulator audio from ID'er feeds to adjust terminal of regulator for modulation on input on regulator output voltage to Gunn oscillator, which produces high quality wideband FM on 10 GHz (See "Above and Beyond" in the June 1990 issue of 73 for CW ID details).

polarization is opposite to the long opening of the waveguide.

If you try to copy a signal of the opposite polarization to what you're running, this will add an additional *30 dB loss*—yes, 30 dB loss—on your end of the circuit. This really makes it difficult to copy signals. Rotating the waveguide or system 90 degrees will help.

Mounting the System

The keyer, Gunn oscillator, and slot antenna are mounted inside a short section of 4" O.D. plastic drainage pipe with top and bottom cap plugs, available at most hardware stores, to waterproof the assembly. DC power is supplied via the cable to the regulator assembly located in the pipe. We usually provide 12 volts at the power supply and regulate the Gunn DC to 10 volts, and the keyer to 5 volts. DC loss is not a problem for moderate lengths of cable; for longer lengths, use 15 volts DC. See Figure 4.

Three beacons have been operating in the San Diego area for at least several years. Maintaining these beacons are Jack N6XQ, at his home on Point Loma overlooking the Pacific; Ed W6OYJ, at his home in University City just north of San Diego proper; and Kerry N6IZW, on Mt. Helix. The latter has served many hams for the years it has been in operation. All have proven valuable tools for microwave use.

Alternate Test Source

If you do not have a beacon or a signal generator in your area, for simple tests you can use the "boomerang," a test oscillator connected to the waveguide detector for the band of interest (10 GHz in this case). You must be using wideband FM and an IF system like the TDA-7000 IF amplifier ("10 GHz Fun," in the April 1990 issue of *73*) which has an IF amp operating at 30 MHz. It's easy to build. All you need is a crystal oscillator at 30 MHz coupled into the detector mount. Don't forget to provide a DC return (RFC) for the detector diode.

When the boomerang receives RF (from the transmit unit), it mixes the received RF with the 30 MHz oscillator and produces a return signal plus and minus 30 MHz back to the transmitter. This signal is not frequency dependent; it will work with any IF (change the crystal to your IF frequency). Also, it does not matter what your 10 GHz frequency is. In this regard, it is very poor to useless for frequency determination, but it gives a low level signal for testing.

Mailbox Comments

Junji Tamura JH1MOY of Japan is gathering components for a 10.475 GHz system. I must admit I do not know the band structure for Japan, but I am looking into this to find out which frequency the activity there is centered on. I hope to have more information on Junji's progress and other microwave activities from Japan.

Ammar Talhouni of Jordan writes that he is finding the microwave articles very interesting, but he is having trouble obtaining materials to construct the Polaplexer mixer and finding a source of Gunn diodes. He would appreciate any assistance. Well, Ammar, I would be glad to provide parts for the Polaplexer. The only additional charge would be for overseas airmail.

Shipping components to any part of the U.S. or Canada isn't a problem, but restrictions on exports to some countries might apply. According to the U.S. Export Administration, items such as Gunn diodes were restricted under tariff ECCN 1544A subpart b,1, but this restriction has recently been lifted. This makes shipment easier, as it now comes under the "general destination" category instead of "controlled tariff."

Kurt AL7LQ/3, a member of the U.S. Coast Guard, reports that he has moved from Kodiak Island, Alaska, to Laurel, Maryland. I know this will add some microwave activity to that part of the woods. Kurt is looking for information on an 11 GHz phase-locked brick manufactured by Micromega, and also for any information on a Huggins Labs TWT power supply model 328D. If you can help him out, write Kurt at 11658 S. Laurel Dr., #2 D, Laurel MD 20708.

Lyle Patison VK2ALU of Wollongong, Australia, writes about 10 GHz operation Down Under. He says it's difficult to obtain microwave components there. Despite this, he used a transformer he got from a microwave oven to construct a 1-watt TWT power supply for a surplus tube. Lyle states that this arrangement works well, but it's not too portable. I have to take my hat off to Lyle, as building a TWT power supply is no small undertaking. It's one that I (with all the components I have available) won't consider.

Lyle says there are two other amateurs in Wollongong on 10 GHz, one on SSB and the other on FM. There are two other SSB amateurs in Sidney, but Lyle says he has a 45 degree elevation rise in their direction, and has to use scatter propagation to make the 60 to 70 km path. See Photos A and B, showing Lyle and his very well-built, home-constructed equipment. His accomplishments are amazing—and in a location where microwave items are scarce. Keep up the good work, Lyle.

Kits and Parts

All kits and Gunn devices that I have mentioned in previous columns are still available at the same prices. Got to hold the line and keep things inexpensive. The only item that has proven difficult to get parts for is the ferrite antenna for VLF frequency calibration.

Add to this list of items the 10 GHz slot antenna described in this column. I have had them fully machined and constructed for those who do not wish to do it themselves from the instructions in Figure 4. The cost of the machined waveguide assembly, end cap, and high quality, commercially gold-plated waveguide flange, is $40 postpaid U.S. The antenna, as machined, exhibits an SWR of less than 1.1:1, about 32 dB return loss. The antenna assembly can be soft-soldered or brazed together in a few minutes. All three parts are a tight fit for final assembly. The flanges included in this kit cost just under $8 each, which was quite a shock to my system. Thought they should run about $4 for new flanges; boy, was my estimate in error.

As always, I will be glad to answer any questions relating to microwave or other topics. Please send an SASE for prompt reply. Chuck WB6IGP.

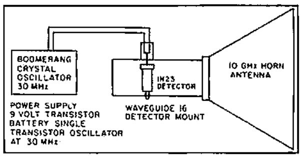


Figure 2. The boomerang. The microwave return signal test adapter receives 10 GHz RF and mixes with 30 MHz. Local oscillator and return microwave RF USB and LSB mix at 30 MHz spacing for receiver testing and antenna aiming tests.

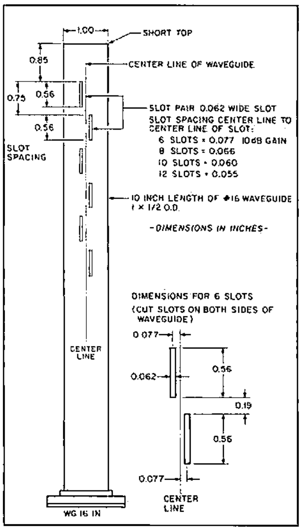


Figure 3. 10 GHz omnidirectional slot antenna, horizontally polarized with approximately 10 dB gain. Use a 10 inch length of #16 waveguide (1" x ½" O.D.) for the 6 slot version. Cut the slots into the 1" wide side of the waveguide, then flip it over 180 degrees and cut slots into the other side to match the slots you just cut out.

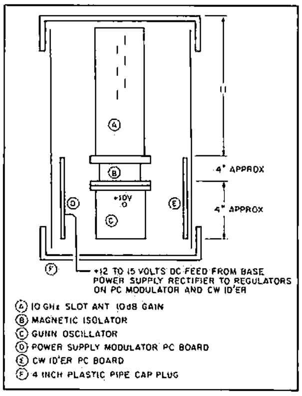


Figure 4. 10 GHz beacon system package. The waterproof DC cable exits from unit at the bottom. Attach a clamp to secure it. Do not place objects near the top of the antenna.

Number 31 on your Feedback card

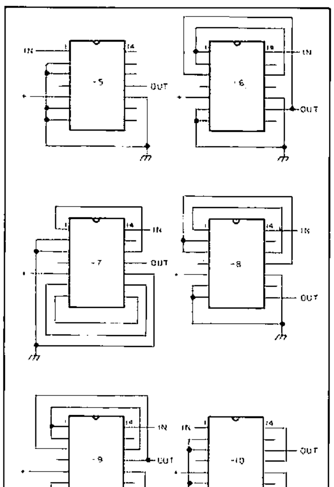
CIRCUITS

Great Ideas From Our Readers

The Versatile 7490 IC

The 7490 (74LS90, etc.) is specified as a decade counter, dividing TTL pulses by a factor of 10. What is not so well known is that this chip can be connected to divide by any whole number between 5 and 10. This lets you use cheap surplus crystals when building a crystal calibrator—secondary frequency standard—which should be in every ham station.

Because published circuits and commercial crystal calibrators use 100 kHz, or 1, 2, or 4 MHz crystals, dealers price these crystals higher than other surplus crystals. Using a 50¢ 7490 IC following any crystal oscillator using a 5, 6, 7, 8, 9 or 10 MHz crystal, output at 1 MHz is produced by properly wiring the 7490. This can be divided further if you wish, using a combination of dual flip-flop 7474s to produce the more usual 100, 50, 25 and 10 kHz marker frequencies (see "An HF/VHF/UHF Marker Generator," *73*, January 1991, p.27). The figure shows the connections which allow the 7490 to divide by 5, 6, 7, 8, 9 and 10.



J. Frank Brumbaugh KB4ZGC
Buffalo NY

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HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Space—The Final Frontier

A classroom visit from Captain James T. Kirk of the *Starship Enterprise* could not have generated more excitement than the radio contact with two real-life astronauts that we had recently.

In early October, I was planning my strategy for introducing a unit on "Space Travel and Communications." I incorporate a major area on space in my ham radio curriculum every term. There is such an abundance of material that I've never taught it the same way twice in more than 10 years. This is a favorite area of study for my 6th, 7th, and 8th graders.

I finally decided that a great opening lesson would be to show an old science fiction movie from the 1950s and compare it to the tapes of shuttle launches and the SAREX tape from the ARRL. Purely by coincidence, when I opened up a session of the CQ All Schools Net, Jay Apt N5QWL was my first check-in. Jay introduced himself as an astronaut from the Johnson Space Center. He had heard about our net with schools across the country, and he wanted to get on and chat with the youngsters. I'm not sure who was more excited—the students or the teacher—but I do know that there was a smile on everyone's face that afternoon.

Jay spoke to the children about plans for future shuttle missions, and about how much he was enjoying ham radio himself. He made a big impression on the youngsters by telling them about the Importance of getting a good education and of considering technical careers. There was electricity in the air! Within minutes of the end of the contact, the rest of the school knew about our good fortune.

For days after the contact, parents contacted me to verify that it was all true, and to find out what we were doing in the ham radio program. What an incredible kickoff to my unit on space communications!

During the next four weeks, the children produced some of the most creative and well-researched reports and projects I have ever seen. Even the more "reluctant learners" came through with flying colors as they presented puppet shows with pipe cleaner astronauts and popsicle-stick space stations.

In the midst of this flurry of space-related activity, on November 13, John WD5EEV, our friend from the Johnson Space Center, checked into the CQ All Schools Net with a special guest. He cryptically told us "This will make your day." He was right! Next at the mike was Ron Parise WA4SIR, to say hello to the children. Once again, the excited looks of delight from the youngsters were a sight to behold. Ron told the class that the crew from the SAREX mission STS-35 was at the Johnson Space Center in preparation for the December launch of the *Columbia*. He also stressed the importance of getting a good education and encouraged the kids to think about entering technical fields of study.

I was privileged to observe the intense looks of pleasure on the faces of the children as they listened to the comments of a man about to go on a space voyage. It occurred to me that the astronauts are the real heroes of our times. The men and women who risk their lives and dedicate themselves to the expansion of scientific knowledge are the ones who are truly worthy of our respect and admiration.

While it may be true that you can't initiate every space unit with a live contact from an astronaut, there are countless high-motivational lessons that can be used to spark the children's imaginations.

The following are a couple of sample lesson plans. If any teacher is interested in getting copies of other space lesson plans, just drop me a line and I'll be happy to mail them to you. Please let me know about creative and successful lessons you are doing with your classes.

Lesson Plan—Shuttle Travel

Lesson Aim: To learn about space shuttle travel.

Motivation: Have students put up space shuttle posters in the room. Ask them to bring video tapes of launches that they taped at home from the TV news. Show the videotape "Space Camp," the ARRL videotape "SAREX," and other related tapes. Point out the role of communications in space travel.

Background: The U.S. space shuttle, the world's first reusable spacecraft, first flew in 1981. After reaching orbit, its two solid fuel booster rockets are jettisoned and then recovered. Its main fuel tank is released when empty; it burns up on re-entering the earth's atmosphere. The orbiter craft—the heart of the space shuttle—looks and lands like an airplane minus the engine. Special heat-resistant ceramic tiles protect it from burning up on re-entry. There are three orbiters in the U.S. shuttle fleet. The shuttle's cargo bay can carry satellites, scientific equipment, or a complete space lab.

Activities, Science or History: Have students research and report on Sputnik 1, the first satellite to orbit the Earth, or any other mission since then. Have committees report benefits to us from missions, such as international communications and TV links via satellite; weather satellites aiding in weather predictions used by farmers, sailors, and airlines; and even hams getting a chance to talk to astronauts while in space!

Activities, Language Arts: After viewing videotapes, elicit responses on what it would feel like to be launched into space. List words on the board appropriate to age level: dizzy, euphoric, light-headed, amazing, unreal, awesome, and so on. Discuss each word and have students write a paragraph describing how they'd feel during lift-off. Have students write a science fiction story about astronauts "lost in space" without their radios.

Lesson Plan for Spacelab

Lesson Aim: To learn about Spacelab missions.

Motivation: Say to students: "Imagine factory workers reporting to work in space. Does this sound far-fetched? Maybe not."

Background: November 1983, the space shuttle *Columbia* was launched with Spacelab 1 in its cargo bay. Spacelab was designed as a place where scientists could do experiments in the unique environment of Earth orbit. Due to weightlessness conditions in Spacelab, handrails and foot restraints were installed to prevent scientists from floating about.

Spacelab has a pallet (storage platform) where materials and equipment can be exposed to space and remotely handled by the shuttle's manipulator arm. The first Spacelab mission lasted 10 days.

Activities, Science or History: Have committees research the benefits derived from Spacelab missions: Group 1), animal research; Group 2), electronics/communications; and Group 3), drugs/medicines. Examples: 1) manufacturing silicon chips (used in computers) could be performed more accurately and economically in space; 2) conditions in space make drug-manufacturing easier; and 3) electrophoresis, using an electrical current to separate materials dissolved in a liquid, can be done with a greater degree of purity in space.

Activities, Art or Language Arts: Have students submit sketches of what a space "floating factory" might look like, then describe it. Have them write a composition telling what kind of people could work there. Describe what it would be like to live in the Spacelab for several months. One thing workers could do during nonwork hours (if they got their amateur license before the mission) is talk to family and friends on Earth by making contacts via amateur radio. 73

The crew of mission STS-35.

ATV

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
Forest Road
Hancock NH 03449

Cross-country ATV Adventure!

On a clear morning this spring, the door to a large blimp hangar in Orange County, California, will open to reveal a 75-foot diameter balloon, a gondola suspended high in the air just below the balloon, and a large ballast balloon on the bottom (see Photo A). Three daring balloonists will ride in the gondola as they attempt a nonstop cross-country flight.

This is a warm-up flight for their nonstop round-the-world flight scheduled for this November. Dubbed *Earthwinds*, the November flight will fly in the jet stream at a constant altitude of 35,000 feet. The three balloonists will ride in a special pressured gondola (see Photo B) suspended between the helium balloon and a unique ballast balloon. The ballast balloon is what makes the mission possible. Its weight can be adjusted by varying its internal pressure through means of a high-pressure fan and release valve. This means that very little ballast needs to be carried, resulting in very long flight duration capabilities. If the winds are favorable, it should take from 11 to 20 days to circle the globe.

Onboard the gondola in November will be captain Larry Newman KB7JGM, Maj. Gen. Vladimir Dzhanibekov (director of cosmonaut training in the Soviet Union), and Richard Branson (who just completed the first hot-air balloon crossing of the Pacific—Newman was the first to cross the Pacific in a helium balloon in 1981).

Since flying with the historic transoceanic balloon crossings of Double-Eagle II (Atlantic) and Double-Eagle V (Pacific), Larry Newman has dreamed of the ultimate ballooning conquest of a nonstop round-the-world flight. After years of planning, it could be a reality this spring.

Work a Balloon

Larry KB7JGM, a very enthusiastic ham, is quite active on 10 meter SSB (recently he's been found around 28.385 MHz). He is a pilot with America West Airlines (see Photo C), and soon plans to operate on 20 and 15 meters while on his twice weekly coast-to-coast Boeing 757 flights.

During this spring's balloon test flight, he will be active on 20, 15 and 10 meters. Listen on 28.385, 21.385 and 14.330 MHz for KB7JGM/balloon throughout the flight. When Larry is not operating live from the balloon, he may have a talking-voice beacon operating on 28.385 MHz to relay their altitude and position. Hopefully schools nationwide can monitor these transmissions and plot the balloon's path as it drifts across the country.

Live ATV from 17,500 Feet

In addition to Larry's HF activities, he plans to operate a complete ATV station! A live color camera attached to the railing of the gondola can be remotely pointed via a 2 meter control link when Larry is busy with other activities. When Larry is not receiving ATV, he'll be transmitting spectacular views of the Earth below that can be seen on 434 MHz (439.25 MHz alternate). Those of you with cable-ready TVs or VCRs can tune in on cable channels 59 or 60 (as long as you connect an outside antenna). Since they plan on flying at 17,500 feet for the cross-country effort, anyone within 160 miles of the flight path should be able to view the ATV signal or contact Larry on 2 meters. He will be monitoring 144.34 MHz FM as well as the HF frequencies.

Photo A. Earthwinds *test flight (Sept. 8, 1990) at 17,500 feet over Mt. Rainier, Washington. The March test flight balloon is identical to this system. Photo by Mark Greenberg/Visions.*

Larry can operate with either vertical or horizontal polarization on ATV. During each night, there is the possibility of a cross-band ATV repeater mode: 434 MHz input/1255 MHz output (AM or FM).

Two lines of telemetry will be displayed at the bottom of the screen showing the altitude, latitude, and longitude; and the temperature, ground speed, and heading. This is accomplished with the aid of a Magellan GPS (Global Positioning Satellite) receiver interfaced to flight computer/video overlay board available from High Technology Flight. The telemetry overlay system was designed by Bob Rau N8IYD and is similar to that used in previous balloon experiments (see High Altitude Ballooning, Photo E in the August 90 issue of *73*). *For more information contact Bob Rau N8IYD, 1450 Jeffery St., Ypsilanti MI 48198-6319. Telephone: (313) 482-2670*

Photo B. Pressurized gondola which will be used for the round-the-world flight at 35,000 feet this November. Artist rendering by Stan Stokes.

Flight Path

Typical spring wind patterns could take the crew along a path across southern California, Arizona, New Mexico, Kansas, Iowa, Illinois, Indiana, Ohio, Pennsylvania and into New York state. The flight could take between 2 to 4 days to complete. Keep in mind that this is only an estimate of the actual flight path. A few days before launch, the actual flight path should be easier to predict.

Due to the current world situation, plans for this spring's flight could change. Listen to the AMSAT nets, the ATV net (3.871 MHz, tues. at 8 p.m. EST) and packet BBSs, for updates.

Photo C. Larry Newman KB7JGM, America West Airlines 757 captain, and captain of the Earthwinds *balloon. Photo courtesy of America West Airlines.*

Photo D. With an ATV receiver you'll be able to see spectacular views such as this one. Don Moses (backup crewmember for the Earthwinds *flight) is dressed in his cold weather gear near the radio operating position. Test balloon at 17,500 feet over Mt. Rainier, Washington (immediate background). You can see Mt. Adams, Mt. Hood, and Mt. St. Helens in the distance. Photo by Larry Newman KB7JGM.*

Desert Voices

Continued from page 18

case another message comes through, and not bother with seeking publicity. The gratitude and recognition of the people you help may be enough for you personally. But no publicity means the larger community remains ignorant of what you're are doing.

In fact, many people have only a vague idea of what a ham is or does, and some may wonder if there is such a thing as a ham anymore. For example, in the first 38 years of my life, lived in five different parts of the country, I only met ONE ham. Though I knew him for 10 years, I didn't know he was a ham until I moved a couple of thousand miles away and began working for 73 *Magazine—and received a letter from him! Hams love to tune in the world on the air—but they forget to tell the world in person.*

Young people are especially affected by this lack of an image for the amateur radio operator. If they have never heard about amateur radio or met a ham, they cannot easily picture them in their minds. Yet young recruits are what amateur radio needs most of all. So, do it: Tell the world. 73

To send a message through Desert Voices to a loved one in the Middle East: First, please write for the proper forms. Address your request to: *Desert Voices Project, POB 23057, Minneapolis MN 55423.* Please do not call on the telephone unless it is absolutely necessary. If it is truly an emergency, and you *must* call to order a form, the number is (612) 463-7202. The office staff is not large enough to handle many incoming calls, and they would not like to have the line blocked.

Number 30 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525-4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Thank you for your cooperation.

I need a schematic for ICOM-726. Mine was destroyed by a pet. Also, i would like to correspond with someone interfacing a Tandy Model 100 with the GLB-PK1L TNC. *Rick Thompson NØHKE, 2079 111th Lane, Coon Rapids MN 55433.*

Does anyone know where I can get a copy of a book called "The Ten Meter FM Hand Book," by Bob Heil? It's been out of print for about five years. I will pay copying charges for this book. *Bret Singer N3IHM, PO Box 1015, East Stroudsburg PA 18301.*

I need a schematic diagram for a Randix stereo cassette receiver, Model #SCR-7104. If you have a mailing address for the Randix Company, please mail the address to me. *Mr. John Sprenkle, 630 Cherokee Ave., Melbourne FL 32935.*

I have a young son with Down's Syndrome, and I would like to increase his speech ability using a speech synthesizer. Has anyone tried to interface Texas Instrument's French Speak & Spell to a computer? I would like to know how to go about making such a modification. I already have the schematic diagram for the Speak & Spell. Or would anyone know of a French speech synthesiser at an affordable price? Thank you. *Gregory McKenna VE2AGY, 33 Marcel, Valleyfield, Quebec, Canada J6S 4M4.*

I just bought a Tandy TRS-80 Model 4D, and cannot find amateur radio related software. I would appreciate copies of Public Domain or Shareware programs. I will pay postage and expenses. *Ibrahim Picard N5LYP, 501 Hudson Drive, Westlake LA 70669.*

I have a Telequipment Model S54A, 10x6 cm display, oscilloscope. The unit has no trace and I need a schematic and/or manual (even an address of the company) in order to complete the repairs. *Steve Reese KE8KF, N11.152 HWY M-95, Channing MI 49815.*

I have a Johnson Viking Invader 2000 6-band transmitter, without a power supply. I need a schematic and/or manual (or address of the company) in order to complete the repairs and build a power supply. *Steve Reese KE8KF, N11.152 HWY M-95, Channing MI 49815.*

Wanted: Instruction book for a Regency Whamo 10 scanner, Model ACT-W10. *R. Fuechsel, 12 Cove Lane Rd., Whippany NJ 07981. (201) 887-4034, evenings.*

I'd like to get in touch with someone who has a manual for a Cushman Electronics Model CE-4B Service Monitor. I'm trying to repair one and I need a copy of the service manual. I will either reimburse you for your copying and postage expenses, or you can mail me the manual and I'll copy and return it. Thanks! *Peter Simpson KA1AXY, 12 Ruthellen Rd., Holliston MA 01746. (508) 429-7069 (home) or (508) 870-9837 (work).*

Wanted: Collins R390 receiver service manual. *Lionel L. Sharp VK4NS, 19 Kelso St., Chermside, Brisbane, Queensland 4032, Australia.*

I need an operating manual and schematic for a Regency HR-2B transceiver. Will pay for copying and mailing. *Doug Stubbs, 69 Goff Rd., Lot 20, Corning NY 14830.*

I would like to obtain any mods available for the Bearcat BC760XLT, particularly increased audio and cellular phone info. *Chuck Kilch, 6083 Deer Run, Middletown OH 45044. (513) 890-7700.*

Wanted: Schematic diagrams for the Yaesu MH-12 speaker/microphone, Heath HW-2 2 meter handheld transceiver. *Glenn Torres KB5AYO, Rt. 1 Box 580-B, Reserve LA 70084.*

Wanted (desperately): DG-5 digital display for mint TS-520. I also need DK-520 kit for installation. I will pay top dollar. *Roger W7LJD, 1690 Allison Rd., Piney Flats TN 37686. (615) 538-8787 (call collect).*

Wanted: Schematic and manual for EICO 753 SSB transceiver. Will pay expenses. *Thomas McWilliams KI4N, 2600 N. Glebe Rd., Arlington VA 22207.*

I'm looking for a software program for the Commodore 64, to run an AMTOR BBS. *Howard Bacon, 213 Holly Ave. So., Pittsburg TN 37380-1313.*

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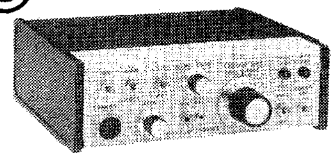

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How to Break Your Radio

In previous columns, we've explored many aspects of equipment repair, from setting up your shop to an overview of the diagnostic process, to the details of stage-by-stage repair. In each case, though, we've assumed nothing about the rig's history up to the point of repair. Often, that's a good approach, because you just may not know why the thing failed. If you do know, though, that information can provide very valuable clues which can save you lots of time and effort. So, this month we're going to look at ways you can break your rig, and what to look for afterward.

Oops...

Here, hold this while I...whoops, CRASH! And that new rig lies crumpled at your feet.

Yes, dropping a radio will usually break it. Sometimes it may appear to work, only to quit a week later. Typically, though, it will exhibit obvious physical damage, and it will malfunction in some major way—like being completely dead.

A dropped rig may be more reparable than you think. Sure, you probably will have to order some new case parts, but the insides may not be ruined. Let's look at what usually happens.

If there's glass, such as a faceplate over a digital readout, it probably will be broken. The readout itself, if fluorescent or LCD, may be cracked and ruined. Especially with a fluorescent readout, check for breakage before powering the rig up. Those readouts use fairly high voltages (around 90 volts) and a damaged one can short and destroy the driver chips or the transistors that run it. A broken LCD will be obvious, with a black line or ooze around the crack. Be careful, because the liquid crystal material inside is toxic. If you get any on you, wash up carefully—you don't want to ingest any of this stuff. And, of course, don't cut yourself on the glass.

The most common kind of internal damage is to the printed circuit board. A cracked board will cause all kinds of problems, and the cracks aren't always easy to find. If you suspect a crack but don't see it, look around the corners and near the edges of the board. Also, check near large parts like transformers, heat sinks, and switches. These areas are especially vulnerable. If you do see a crack, try to determine which circuit traces are affected. Sometimes you can simply bridge a few broken lines and be back in business. Other times, it's not that simple. Today's complex products, and especially miniaturized items like HTs, often have multilayer boards with conductors running *through* their centers, or in layers underneath the visible one. In cases like that, the rig may truly be irreparable. I've tried a few times, but I've never had any luck fixing cracks in multilayer boards.

Solid-State and Surface Mount

Solid-state parts, such as chips and transistors, are not very sensitive to mechanical shock, and you really don't have to worry about them unless they have visible cracks. Glass diodes are an exception, as they break in half rather easily. Other parts should be examined. Leads can break off from electrolytic capacitors, and ceramic caps can crack in half. Coils, especially those with hair-thin wires (such as IF coils), can break those wires from their terminating pins. The iron cores can crack, leaving the coil way off frequency, even though it still functions. In particular, resistors tend to break with tiny, invisible cracks. Sometimes they'll still work intermittently, as the two halves touch and separate with temperature. To be sure, wiggle any suspect resistors slightly. A cracked resistor will usually separate when moved.

Surface-mount parts are another story altogether. They are soldered with low-temperature solder in a reflow process, which is something like reheating previously soldered connections without adding new solder. In my experience, the joints are much weaker than the normal kind, and a drop to the floor may create some touchy intermittents. The parts themselves seem pretty strong, but test any iffy ones just like you would resistors. Of course, if the part breaks, you are almost certainly going to have to try to decipher its function (resistor, cap, etc.) and value from a schematic, because many surface-mount devices (SMDs) are unmarked. That's the price you pay for a full-function walkie you can slip into your shirt pocket.

If the rig fell on the switches, they may be bent or broken. Order new ones. The same goes for connectors, knobs, and moving parts in meters. Surprisingly, you may find that small incandescent lamps have survived the drop. They just don't seem to have the mass to break. Also, LEDs almost never succumb to mechanical failure.

Ben Franklin Was Right

Lightning *is* electricity. And if it hits your antenna or your power lines (the more common entry point), bye-bye radio. A direct hit is likely to do so much damage that the rig may actually melt! Most strikes, however, are not true hits. In many cases the bolt hits somewhere close by, and the surrounding charge, which is enough to knock you straight to the morgue, is what zaps your rig.

As mentioned above, many lightning strikes come into your home through your AC wiring. There's lots of wire out there above the streets, and it's all a handy target for a discharge. So, if you've been hit and the rig is dead, go straight to the power supply. After unplugging it, check the transformer for continuity. Check the fuse. Undoubtedly, the rectifiers and regulator will be open. After replacing them, you may find that there is no other damage.

If you do get hit in the antenna, the rig's front end is probably fried. FETs just don't like megavolts instead of microvolts! If there's an antenna relay, it may be fused into the receive position for eternity. A new one will do the trick. If you have solid-state (diode) TX/RX switching, many of the diodes may be destroyed. This can be tricky because there are so many of them, and you might have to check them all. Sometimes just finding them can be hard. I remember one HF rig which had a shorted switching diode (not due to lightning) that I just couldn't find. Six hours later I found it buried in a corner of the board, under some other parts. It wasn't in the service manual or the schematic. Grrrrr.

We don't always rely on Mother Nature to zap our equipment; sometimes we do it all by ourselves. Particularly in the case of new amateurs, there can be considerable confusion about the proper connections for power, audio, etc. A great deal of this is due to poor manufacturer documentation, with ambiguous wording and linguistic translation errors.

Polarity

The easiest and most commonly performed mistake is reversing the power polarity on 12 volt DC gear. It's amazing how often this happens. Once and for all time: *Red is positive (+) and black is negative (−).* Always. Really. And in a car, the chassis is negative and should go to the black lead. That is, unless you have an old, exotic European car like a VW bug.

If you do reverse the polarity, you will probably see smoke come out the back of the rig. Believe it or not, that doesn't mean the radio is destroyed. Many sets have protective diodes across their power leads. The diode is connected backwards so that it doesn't conduct in normal operation. When the polarity is reversed, the diode conducts, taking nearly all the current and protecting the rig for the few milliseconds before the external fuse in the DC power line blows.

At least, that's the way it's supposed to happen. Unfortunately, many people don't bother to fuse the power lines, so the diode conducts just like a continuous short circuit until it smokes and/or explodes. All of this can occur in a second or two. If the diode opens, which is likely, the rig will get the full brunt of the reverse voltage and be seriously damaged.

First, check the diode. It may be shorted, and there may not be any other trouble. If not, or if there is no diode, head straight for the voltage regulator. It is probably open. Sometimes a new regulator is all you need, because the old one's opening has protected the rest of the circuitry. Oh yes, be sure to replace any electrolytic capacitors connected before the regulator. Those caps just won't tolerate *any* reverse voltage. If reverse power has gotten to the rest of the circuitry, check power devices, such as audio power amps and RF finals, before anything else. Many low-level-stage parts, such as ICs and transistors, are connected through resistors or secondary regulators and won't be damaged. Small-signal diodes are almost never damaged by a power reversal. After all, they are designed to block reverse voltage anyway.

Cap'n, She Can'na Hold

High SWR will make your RF come back at you. Although all solid-state HF rigs have protection circuitry, sometimes it may not be enough. Also, some VHF/UHF rigs have no protection. At least on HF, common causes of high SWR include operator error (oops, forgot to turn off the auto antenna tuner when I changed bands), momentary mistuning of manual tuners, and antenna failures or coax damage. Generally, rigs will tolerate short-term SWR problems, but they don't like it for too long. That's one area where tubes definitely were better.

Typically, SWR damages the RF finals. They often open, so there is no RF power out. They can also short or become leaky, which will result in very low power out and probably some distortion. And, perhaps, a rather warm rig. The SWR protection circuitry may also be damaged and should be checked first.

Microphone input circuits are designed to accept small AC signals. They may be damaged by DC power or severe overload due to excessive input signals. I don't mean yelling into the mike; I mean connecting the earphone output of a tape recorder and turning it up nice and loud. Check the first transistor or IC for an open circuit.

Audio output jacks are a prime source of trouble. A short will very likely destroy the audio power amp. It is best to turn the rig off before connecting an external speaker, because the jack can short for a moment as the plug is slid in or out. Now and then, that moment is enough to cause damage.

Never ever connect two audio outputs together. Inexperienced operators sometimes do this because they want to mix two radios into one speaker. This is almost certain to damage both rigs! If you need to mix, buy or build a suitable mixer circuit which will isolate the two radios' outputs and avoid the damage caused by one rig's audio power frying the other rig.

Any time a radio is damaged via the speaker jack, head straight for the audio power amp. Also, check for the presence of an electrolytic capacitor between the amp and the jack. If there is one, replace it; it is almost certainly leaky or shorted.

Well, that's it for this month. See you again next time. 73

Dx

Number 23 on your Feedback card

Hams Around the World

Bob Winn W6KNE
c/o QRZ DX
P.O. Box 832205
Richardson TX 75083

VK9 Norfolk Island: Ham Radio and Stamp Collecting

The Norfolk Island Philatelic Bureau has announced the issue of three stamps commemorating ham radio. The set of stamps will be issued April 9, 1991. The stamp designs feature different maps of the island and the callsigns of the island's five amateurs: VK9JA, VK9ND, VK9NI, VK9NL and VK9NS. Values: 43c, $1.00 and $1.20. A first day cover will cost $2.83 (Australian $). Additional information may be obtained from (or orders mailed to) Philatelic Bureau, Norfolk Island 2899, Australia. Thanks, VK9NS.

TN6PG and TN6PG/D2

The operations by TN6PG and TN6PG/D2 are thought to be the work of a pirate. The operator is said to QSL via G3OCA, who knows nothing about these stations.

ZS9Z/1 1990 DXpedition to the Penguin Islands

DXpeditions don't just happen, and they are not necessarily vacations. A successful DXpedition requires detailed planning, logistical support, research, and dedicated operators. The following DXpedition report, provided by N7NG, tells part of the story of the second DXpedition to the Penguin Islands of South Africa.

The South African (RSA) Penguin Islands are located off the coast of Namibia, with Namibia left in between as an "intervening DXCC country," thus qualifying the Penguins as a separate DXCC country under Points 1 and 3 of the DXCC country criteria. An application for separate DXCC status is pending, and a DXCC vote is expected momentarily.

ZS9Z/ZS1 operators N7NG, OH2BH, OH2RF and ZS6BCR arrived on the coast of Namibia November 27 and made their first attempt to land on Seal Island that same day. The only possible landing site was battered by heavy seas, so it was impossible to move a large quantity of DXpedition gear. Some operators were put ashore, and they found traces of the original German DXpedition to that island.

On Wednesday, November 28, a more successful attempt was made to land on a neighboring rock called Penguin Island. The weather was excellent and the landing area seemed much more favorable, but it was situated on the wrong side of the rock, which blocked an unobstructed shot at the northern sector, and blocked all of the U.S. and Japan on long path.

To avoid any unpleasant surprises, the group brought more than one mile of RG8/U coax to reach the highest tip of the island, and to have the beams out in the clear. They spent one whole day under intense sun conditions, carrying and mounting a 40-foot Rohn with a Hy-Gain TH5 on top. Another tower supported a Hy-Gain 103BA, while Butternut verticals were used for the lower bands. We sincerely hope that the ZS9Z/ZS1 signals proved worthy of that effort.

Some 33,200 QSOs were made during the six days of operating. Two ICOM IC-735s with amplifiers were supplied with 6 kW of generator power. The first days and the weekend were spent on selected bands to provide everyone with at least one contact. Some RTTY and WARC band operating was launched for the first time from Penguin, and a brief showing was made on 80/160 toward the very end.

Facilities on the island were highly limited, and the operating was done from the remains of a guano community that had existed there a long time ago. The birds were relatively agressive, and there were nests everywhere. The conditions were next to hazardous, and the smell was horrible. All the nests in the vicinity of the operating site and on the way to the towers were protected by markings.

Despite many rumors to the contrary, landing permissions were on hand for both Seal and Penguin Islands. A South African (RSA) delegation from the Department of Nature and Environmental Conservation landed during the operation to make sure that the ecological balance on the island was not disrupted.

The last 20 hours of the operation used Butternut verticals only, and the operation wound up immediately after sunrise on December 6, 1990.

Many logistical phases had to be successfully completed to secure this DXpedition. Derek Moore V51DM played a major role in providing assistance and supplying a master cable to reach the top of the island, and in placing his fleet of air rafts at the disposal of this DXpedition. Thanks are also due to Harold Lund ZS6WB in Pretoria for loaning us the generators, and for coordinating and supporting railway container shipments through South Africa and providing a four-wheel drive vehicle with a trailer for nonstop driving from ZS6 to the coast of Namibia, a 30-hour drive. And, we wish to credit Ian Sutherland ZS9A for offering highly valuable assistance in planning the landing and the setup on Penguin Island. A major local organizing burden was borne by Chris Burger ZS6BCR, one of the operators.

The cost of logistics for an operation of this magnitude was extremely high, but many institutional and private parties have moved in to offset the logistical expenses.

Please note that V51Z (CQ WW CW contest only) and the Penguin Island DXpedition will be QSLed via Martti Laine OH2BH. The rescheduled ZS9Z operation from Walvis Bay (active during mid-December) will QSL via ZS6BCR.

QSL Routes

4M1G	Via YV1CLM
4M3B	Via YV3BKC
4M5T	Via YV5JBI
4M5Y	Via YV5LAS
4N1A	Via YU1FJK
4N4C	Via YU3EZC
4N4W	Via YU4GYZ
4N7M	Via YU7KMN
4N7ZZ	Via YU7FIJ
6FXBCS	Via VE7DP
9M6ET	Via WB2KXA
9M6OO	Via N2OO
9M8ZR	Via WA2HZR
ATØT	Via KE3A
ATØV	Via VU2CVP
CEØZZZ	Box 13312, Santiago, Chile
CQ5ASM	Via CT1ASM
CT2A	Via CT1BOH
D68GA	New Address: Don Jones, N6ZV, 1605 Avenue O-4, Palmdale, CA 93551
DX1A	Via DU1AU
DX8A	P.O. Box 5616, Iligan City 9200, Philippines
ED3MM	Via EA3BOX
HBØ/HB9AON	Via DJ2YE
HG1S	Via HA1KSA
HG1W	Via HA1YA
HG4P	Via HA4ZZ
HG5A	Via HA7RY
I1A	Via I1RBJ
INØG	Via IKØGPP
IQ3A	Via I3MAU
J43A	Via SV3AQR
J6LRU	Via W8ILC
JT1T	Via JT1KAA
KP2A	Via W3HNK
L4D	Via LU4DCK

LWØDX	Via LU4HH
LX9DD	Via LX1GQ
LZ5A	Via LZ1KGB
LZ5Z	Via LZ1KDP
LZ6W	Via LZ2KSQ
LZ6Z	Via LZ2HKM
LZ9A	Via LZ2KTS
OD5IM	Via F6CYU with 4 IRCs
OD5YU	Via KC4DWI
OR4EEC	Via ON bureau
OT5LO	Via ON5LO
P4ØA	Via N1GL
PJ2/OH9RP	Via OH9RP
SN3A	Via SP3GEM
SN6O	Via SP6PAZ
T3ØX	Via DJ6SI
T32Z	Via N7YL
T33R	Via OH3GZ
T33T	Via OH3GZ
T33WV	Via DK2WV
T33X	Via DJ6SI
V2/G6QQ	Via G6QQ
V85OM	Via N2OO
WN4KKN/ZP5	Via AA5BT
YJØARW	Via ZL1AMO
YPØA	Via YO9HP
YT2B	Via YU2KDE
YT2R	Via YU2CRT
YT3M	Via YU3DJK
YT3T	Via YU3EIJ
YT4T	Via YU4ECJ
YT5R	Via YU5GBC
YT7A	Via YU7GMN
YT9ØA	Via YT3AA
YW3A	Via YV3AZC
YW5Y	Via YV5LAJ
YW6W	Via YV6CAX
YZ4Z	Via YU4EXA
YZ7V	Via YU7ECD

QSL Notes

ZL1BQD still has logs open for the following operations:

FKØRR	New Caledonia	September 1981
VK9NR	Norfolk Island	January 1982
3D2RJ	Fiji	September 1982
ZL8BQD	Kermadec Islands	March 1984
ZL1BQD/KH6	Hawaii	October 1985
5W1FP	Western Samoa	March 1986
ZK3RR	Tolelau Island	March 1986
ZL9BQD	Auckland Islands	February 1988
3D2RJ	Rotuma	August 1989

And, he is the manager for ZLØAJW/8 and 3D2AH (Rotuma). QSL to Roly Runciman ZL1BQD, 36 Cardiff Rd., Paluranga, Auckland 1706, New Zealand.

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Several hams have heeded my plea for hambassadors. I guess they just couldn't pass up the offer of a FREE airmail subscription to 73 Amateur Radio Today. *Offering to become hambassadors were Charles Martin AB4Y, on his way to Saudi Arabia for a year; Mike Lazaroff KB3RG/CU3LF, presently on Terceira Island in the Azores; and Robert Wright XQ6EK, a resident of Chile and radio officer on merchant vessels.*

Another hambassador has been added through the efforts of Bill Brown WB8ELK, our managing editor. Hans van de Groenendaal ZS6AKV will step in to keep us informed of happenings in South Africa. Many of you know Hans through his AMSAT efforts and ham ballooning. One of his articles, "Give a Lift to Your ARC," on Balloon Carrying Amateur Radio, or BACAR, was in the March 1990 issue of 73.

I am sure much has been happening in these countries during the past several years. No one has reported from Saudi Arabia since December 1984, from Chile since May 1988, and from Portugal/Azores since July 1988.—Arnie, N1BAC

Roundup

Greece *A letter from the Greek Mountaineers' Club: 5; Aristotelous Square, Thessaloniki 54624, Greece.* This report describes the radio activities of members of the Greek Mountaineers' Club in the Caucasus region last August. The club operates a licensed VHF rescue network (slightly above the 2m amateur band). On two occasions in 1990, the network proved invaluable in initiating and coordinating mountain rescues by helicopter. Many members also engage extensively in mountain-topping amateur radio activities.

The club conducts ongoing tests to explore and develop the network's capabilities. In the course of these tests, radio amateurs SV2AHT, SV2AHJ, and SV2BBQ took along HF and VHF equipment on a mountaineering expedition to the Caucasus region (in the U.S.S.R.) last August. Two meter handhelds by Yaesu and ICOM provided communications during the ascent of Mt. Elbruz (5,642 meters). No amateur contacts were made, as amateur activity in the 2m band was conspicuous by its absence.

SV2AHT made a number of interesting OSOs in the 20m band in the period of August 21 to August 30, 1990. The station was located at 4,200 meters above sea level. Temperatures reached −10°C. *[Was that the high or low, I wonder? Brrrrrrr!—Arnie]* Stations contacted include VK, 5B, SV, N, UA, KA, DJ, and I.

The transceiver was a GCR-250 all-band, all-mode rig manufactured in Greece. Running at low power (8–10 watts out), it displayed fairly low power consumption. The NiCd batteries powering the unit were recharged by portable solar cells. The antenna was a 20m dipole. 73s from Vassilis Toulis, SV2BBQ. *[Vassilis sent along some beautiful photos and they will be presented in this and succeeding issues.—Arnie]*

Japan *From the JARL News.* On November 14, 1990, 55 members of the 32nd Japanese Antarctic Research Expedition left Tokyo on board the icebreaker *Shirase* for a two-year tour of observation duty in the polar regions. Mr. Hara JA1AN, president of JARL, along with other JARL members, met to see them off.

A week earlier, Mr. Toyoshi Arisawa JA4EDV, together with three other members, all in charge of communication on the expedition, attended lectures on amateur satellite operation delivered at the Technical Laboratory of JARL. Needless to say, acquiring such knowledge will prove a must in their attempts to communicate via satellite from amateur radio stations 8J1RL in Showa Base and 8J1RM in Asuka Observation Base. Eleven members of the team hold amateur radio licenses. They will be eager to receive news, and anticipate both stations to be on the air from 0930 to 1030 UTC, mainly on 7, 14, and 21 MHz. *[A full listing of JARL Beacons was listed in this issue of* The JARL News, *but it's too lengthy to present here. Look on the 73BBS under 73INTL SIG, "JARL Beacons."]*

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena 49/701
20270 Rio de Janeiro
Brazil

Best wishes to all in this coming 1991. May there be Peace and Fraternity in this world we live in.

We are having a kind of QRP boom in Brazil, as only CW QRP equipment is being produced the artisan way in São Paulo. The equipment provides 5 watts output and is priced at $180 to $200, thus allowing beginners to start CW operations reasonably cheap. We've heard about a new QRP rig from the Japanese, with crystal filters and plenty of other items "for JUST $1,300"!!

Coming back to home-brew QRP equipment, I am looking for a linear amplifier schematic that will bring 3–4 watts up to 30–40 watts. If anyone has a good one please send a copy to me directly or to Arnie at *73* and he will send it to me.

I think many Brazilian hams are now discovering the Islands On The Air (IOTA) award program, and as we have islands by the hundreds along the coast, we are trying to develop DXpeditions by interested groups to "shake up" the sleepy amateurs all over.

As my part of this shake-up, I am presenting two DXpeditions, one to Trindade Island and the other to São João Island. Best wishes for the coming year. *[The trip to Trindade Island will be presented later.—Arnie]*

São João Island, IOTA S.A. 41. Raising the international interest for its program, the IOTA is offering a new potential to radio amateur development, and especially for the adventures of DXpeditions, like this one to São João Island. That old feeling for adventure once again "pushed" Ronaldo PS7AB and Tino PT7AA toward a different and exciting DXpedition to São João Island, officially known as Maiaiu Island, some 30 miles off the Brazilian coast north of Maranhão state.

This island is part of an archipelago with tens of smaller islands, some of them inhabited by fishermen and their families. On São João Island is a 35-meter-high lighthouse erected by the Brazilian Navy.

Leaving Natal City by bus, they took some hundred kilos of equipment over extremely damaged roads and prehistoric wooden bridges for about 2,200 kilometers. On reaching Apica-Açu village north of Maranhão state, they boarded a small fisherman's boat for a 13-hour trip, four of the hours on open sea. This was the most unexpected "rally" for Ronaldo PS7AB, not used to such adventures.

For Tino PT7AA things ran differently, coming straight from São Luiz City, the capital of Maranhão, by boat, also with high seas during the 48-hour trip, with 10-meter-high waves during the 160 mile travel, praying all the time for the small boat's safety!

And then, São João Island, a real paradise, safe from any ecological damage, splendid and rich tropical flora, endless cocoa tree groves, lovely birds of all colors, as the Guará in its glorious red color, and a sea of limpid waters, a tepid habitat for an enormous variety of fish, shrimp and crustaceans, clear sand and sandy hills as beaches, a real dream.

The island is located at 01°17'S–44°54'W, 30 miles off the coast of Maranhão, fishermen's boats the only way to shuttle over.

With the Navy "permit" to share part of the lighthouse, we had rooms and bathrooms, and power. We had our "shack" for the Kenwood TS-430, ICOM IC-725, AT-130 and AT-250 couplers, a Brazilian Spectrum electronic keyer, Shure 444D microphone, and two vertical Electril multiband antennas, one of them up 35 meters on top of the lighthouse.

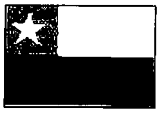
Tino operated as ZX8CW (CW mode) and Ronaldo as ZX8DX (SSB mode) from 5 to 13 October 1990. They made 3,037 phone QSOs in 104 countries, and Tino made 1799 CW QSOs in 67 countries. Using Vee antennas, they got very good results from America and Europe, and not so good for Asia and Africa.

São João Island is 7½ km long and about 1½ km wide, with the lighthouse on one end, and a fisherman's village on the other, with a beach called, "Bate o Vento" (wind blowing). The island has a normal temperature, about 28°C and almost no rain.

I asked Tino by radio after the expedition was over, "So Tino, was it all worthwhile?" The answer came back straight and sure, "Of course, Carl! It was marvelous, no matter what problems, and we will never forget the fantastic scenery of São João Island."

Special thanks from the DXpedition members to the Navy people living there, four families; and a very, very special 73 to Vanderley Valente, a Navy corporal for 10 years in charge of the lighthouse, for their friendly sympathy.

Photo A. SV2AHT, SV2AHJ, and fellow mountaineers with the HF rig.



CHILE
Robert M. Wright XQ6EK
Casilla 1259
Osorno
Chile
South America

Hello to all amateur radio operators. I am very glad to become the hambassador for Chile. Let me tell you something about myself.

I am a radio officer on board merchant vessels, holding licenses as such in the countries of Great Britain, Panama, Liberia, and the United States. I have five years of seatime and have worked many years as a radio operator at coast stations, such as WPD and WKM.

I hold nine amateur radio licenses, Canada Superior Class VE2OST, U.S.A. Extra N4VBG, Diego Garcia VQ9MW, Chile Superior Class XQ6EK (XQ is a First Class prefix in Chile, only 100 in the entire country), ex-DJØGB in Germany, and many others. I am 26 years old, 11 years an amateur operator, married (my XYL's callsigns are CE6POP and KC4LQD), and live on a dairy farm about 1,000 kilometers south of Santiago when not working my eight months a year at sea.

At my home QTH, I work an ICOM IC-735, amplifier of 500 watts or so, and a Cushcraft R-5 ground-mounted antenna. I also have a 100-foot tower where I will soon install a yagi or quad beam antenna. I am very active on 2 meters as well. I speak Spanish, German, and English.

I hope I have a chance to talk to many of you in the years to come, and I ask that all amateurs of Chile send me information of happenings in their areas. 73 to all.

LITHUANIA
Jonas Paskauskas LY2ZZ
PO Box 71
Siauliai 235400
Lithuania

The Lithuanian Amateur Radio Conference will be held in Vilnius, Lithuania during the first week of June 1991. The conference will last approximately 7–10 days. It will start in the capital, Vilnius, then move on to Kaunas, Panevezys, Siauiiai, and Palanga, a resort town on the Baltic Sea.

To date, 26 amateurs from outside Lithuania are planning to attend: 15 from the U.S.A., three from Canada, four from Germany, two from England, and two from Scotland.

If you wish more information, or wish to attend, please contact me at the above address with your requests. I'm looking forward to the conference and to meeting some of the hams that I have talked to on the air. *[The conference scheduled for last June had to be canceled due to the political climate at that time. We hope nothing will prevent the conference this year.—Arnie]*

Lithuanian yachtsmen are in the process of outfitting a sailboat for a trip around the world, to last approximately 18 months. The purpose of the trip is to show the flag and visit major Lithuanian colonies. The crew of 18 will include a licensed radio amateur with a special event callsign. More on this later, as more information becomes available.

NEW ZEALAND
Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Now that 1990 is over, the NZART year can be viewed in retrospect.

Late 1989 saw the beginning of NZART managing the entire administration of amateur examinations on behalf of the New Zealand Frequency Service (NZFS) of the Department of Commerce. Applications are processed by NZART HQ, the examination centres set, the preparation and distribution of the examination papers, and the arranging with the branches for approved members to supervise and conduct the exams. When the exam is completed, the papers are returned to NZART HQ for marking, and the candidates are advised of the results directly from NZART HQ within several weeks of the exam date. Before, when the NZFS supervised and conducted the exams, it took two to three months.

The NZ Frequency Service is also favourably considering the transference to NZART of the administration and testing of candidates for Morse code. We anticipate this will take place before March 1991.

New school radio clubs have formed during the year. The increased interest in amateur radio has become evident by the many school clubs heard on the air during lunch breaks, and many schools are now featuring amateur radio in their Open Days.

From 1 November 1990, the NZFS approved the use of 2 meters (144–148 MHz) by Novice operators. The regulatory body refused the initial request from NZART in March, but after further submissions, agreed. So now, if there are reciprocal rights between NZ (ZL) and your country, as a visiting Novice operator, you will be able to operate on the 2m band.

This year ZL amateurs are participating in an IARU International Monitoring Service. From 1 March 1990 through 24 February 1991, amateurs and nonamateurs (listeners) are monitoring set frequencies outside the ham bands 24 hours each day, to identify the unused or rarely used parts of the radio spectrum adjacent to the amateur bands.

NZART Conference, 1991

The 1991 NZART Conference will be held at Marton, NZ. The "Martian Conference" venue will be an agricultural training facility, called Flock House, near Marton. The venue has graded accommodation facilities as follows: Executive—$81.70 per day; Business, $57.15 per day; and Thrifty, $30.85 per day. If you prefer to camp, it's $3.00 for adults and $1.62 for children per day.

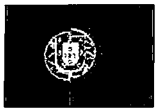
If any overseas amateurs are visiting during May/June, the conference dates are 31 May through 3 June, a full weekend of amateur radio activities centered around the annual meeting of NZART, and plenty of social activities as well. The accommodation and conference venues are all within the complex at Flock House; therefore, you can walk from place to place with no worries about transport.

Recreational facilities are good—an indoor heated pool, squash courts, tennis courts, and a sports field. If any of my overseas readers are interested, write to me and I will send your letter on to the organizing secretary.

New Bands for ZL Recently, as a result of submissions made on our behalf by the Frequency Management Technical Advisory Group (FMTAG) of NZART, the NZFS made two new bands available to ZL amateurs. The two bands are 165 to 190 kHz (1700m), with a maximum EIRP of 5 watts; and 922 to 927 MHz (32cm), with a maximum EIRP of 25 watts. FMTAG is presently formulating possible uses for these two new bands, maybe in some specialty communications areas. The bands are available on application to the holders of the ZL General licence.

Other items: The new QSL address for ZL is: B.E. Stewart ZL2RR, PO Box 857, Wanganui, New Zealand.

Terry ZL3QL, NZART President, is on temporary posting to Los Angeles with Air New Zealand as a 747 captain. He should be on the air from L.A. during his time there.



PORTUGAL/AZORES
Mike Lazaroff KB3RG/CU3LF
PCS Box 1687
APO New York 09406

I'm a 15-year veteran of the United States Air Force and currently stationed on Terceira Island in the Azores (CU3-land). I would love to write reports on the Azores and ham radio.

Operating from here is a ball—the bands are open all the time, and the CU call seems to add 15 to 20 dB to your signal! I'm active on all bands, 160 to 10m on CW, SSB, packet, and RTTY.

[For those amateurs in Portugal, feel free to send your ham information to Mike for inclusion in the column, or you can send the info directly to me. —Arnie]

Number 25 on your Feedback card

UPDATES

Jan. '91 "Circuits"

See the schematic for KB4ZGC's regulated voltage distribution box on page 58 of the above issue. Note that the inputs to regulators 7808 and 7806 should be joined to the line from the output of LM317, in the same manner that regulators 7805 and 7809 are.

Jan. '91 "Frequency Standard"

See the above issue for the article, "High Precision Frequency Standard," by Johnson, on page 9.

John H. Davis, Chief Engineer WJSP-TV/FM: "It is no longer possible to rely on a TV station's sync to atomic precision, even during network programs, except in a relatively few cases. The development of affordable digital frame synchronizers in the past decade has changed things. Nearly all stations use one or more of them.

"The frame synchronizer digitizes incoming video, then plays it back in step with the station's *local* sync generator, which is usually *crystal controlled.* There are a few exceptions, but well over 80% of stations are referenced to a local crystal 100% of the time. Mr. Johnson's circuit seems solidly designed, but be very sure of your reference!"

Bradford E. Scott WD9HDZ, engineer at WCET: "A network signal processed through a frame synchronizer no longer maintains the rubidium-standard accuracy, but instead exhibits the characteristics of the local station's sync generator, which usually uses a quartz crystal. This local oscillator is adjustable, and must be periodically calibrated. The FCC requires that broadcast TV stations keep their color subcarriers accurate to within plus or minus 10 Hz, or within 2.79 times 10 to the minus 6th percent. Thus, a calibration reading taken from a station using frame synchronizers may be inaccurate by that amount."

Paul D. Roehm KB9CLA, works for WRTV: "In all but the smallest TV markets, incoming network video is run through a frame synchronizer. Because of this, the accuracy of the 1 MHz signal generated by the PLL would have the accuracy of the sync generator at your local television station.

"All network programming is sent to your local station by satellite. All satellites, even geostationary ones, have Dopper shift. Though small, about 1 Hz, the shift may cause short-term errors in your frequency standard. Where Mr. Johnson lives, in Los Angeles, the local TV signal is coming from the same source as the network, rather than from the satellite. If you live in Los Angeles or New York, the circuit will work for you.

"All is not lost, however. Some stations, including the one I work for, are locked to the WWV 60 kHz signal as a condition of their license. If you can change the system to lock to their visual carriers, then you are home free." 73

SPECIAL EVENTS

Number 26 on your Feedback card

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

MARCH 2

ABSECON, NJ The Shore Points ARC will hold its 9th annual hamfest, "Springfest '91", at Holy Spirit High School. Doors open at 9 AM. Set-up at 7 AM. Reservations will be accepted for tables in the heated indoor selling area. Outdoor tailgating space available, weather permitting. Limited AC. Sellers: $5 per 8' table; buyers: $4. Talk-in on 146.385/.985. Write to: *SPARC, P.O. Box 142, Absecon NJ 08201.*

ALAMOGORDO, NM The Alamogordo ARC will hold VE Testing at the Alamogordo Mid High School, South entrance, beginning at 12:00 noon. Contact *Marilyn Redman, Public Information Officer, Alamogordo ARC, P.O. Box 1191, Alamogordo NM 88310.*

CAVE CITY, KY The Mammoth Cave ARC will sponsor their 15th annual Glasgow Swapfest at the Cave City Convention Center, beginning at 8 AM Central time. Admission is $4 per person, tables $5 each. VE exams, walk-ins welcome. Talk-in on 146.34/.94. Contact *N4HCO, 1379 Whites Chapel Rd., Glasgow KY 42141.*

MARCH 3

YORK, PA The Fourth Annual York Springfest (Ham & Computer) will be held at the Dover Fire Hall starting at 8 AM. Admission $4, unlicensed spouse and under 12 free. Tailgating $1. Inside tables $10. VE Exams. Talk-in on 146.37/.97 and 147.93/.33. Contact *York Springfest, P.O. Box 316, New Freedom PA 17349-0316. (301) 239-3878.*

ROSTRAVER TOWNSHIP, PA The Two Rivers ARC of Mc Keesport will hold its 18th annual Swap and Shop at the Rostraver Volunteer Fire Hall from 8 AM–3 PM. Admission is $1. Contact *Mr. Michael Kowalcheck KV3L, (412) 751-9657.* Directions will be available on the WA3PBD repeater, 146.13/.73.

MARCH 8

ST LOUIS CITY, MO The Jefferson Barracks ARC will hold their 31st annual Amateur Radio Auction at the Concordia Turner's Hall. Doors open at 5 PM and the Auction starts at 7:30 PM. Talk-in on 144.61/145.21 and 146.34/.94 repeaters after 5 PM. Contact *Carl H. Hohenberger WB0BPZ, 5266 Parker Ave., St. Louis MO 63139-1340. (314) 351-7084.*

MARCH 9

TULLAHOMA, TN The Middle Tennessee ARS will hold an Old-Fashioned Swapfest at the Tullahoma TN Airport, Hanger #6. Talk-in on 146.10/.70. Contact *Richard Johnson W4SFF, 109 Dogwood, Winchester TN 37398.*

MT. ARLINGTON, NJ West Morris Wireless and Splitrock ARA will sponsor the annual North Jersey Hamfest at the Mt. Arlington Sheraton beginning at 8 AM. Set-up at 6 AM. VE Exams begin at 8:45 AM. Admission $5, XYLs and children free. Tables $15. Talk-in on 146.985/.385 and 223.860/2.260. Mail table registrations to *PO Box 610, Rockaway NJ 07866,* until Feb. 28. Late registration, call *Bill WR2M, (201) 770-0242 till 10 PM,* or *Bernie WB2YOK, (201) 584-4423.*

ROSELLE PARK, NJ The Student Body of Roselle Park High School and the Old Bridge Radio Assn. will host the Roselle Park Family Computer/Ham Festival. Flea Market from 9 AM–4 PM, plenty of tailgate space. Admission $5. Talk-in on 146.520 simplex. Contact *Computer Exposition and HamFest, Roselle Park High School, 185 West Webster Ave., Roselle Park NJ 07204. (201) 241-4450; or BBS, (201) 241-8902 (24hr 300/1200).* Directions: Garden State Parkway Exit 137 to East on Westfield, 3rd light, left on Locus, left after RR underpass.

MARCH 10

BRISTOL, CT The Insurance City Repeater Club will hold its annual Amateur Radio/Computer Flea Market at the Bristol Eastern High School from 9 AM–2 PM. Admission is $3. Six foot tables are $12. Contact *Chuck Motes K1DFS, 22 Woodside Lane, Plainville CT 06062, (203) 747-6377.* VEC Exams by registration only. Contact *Sue Fredrickson WM1B, PO Box 165, Pleasant Valley CT 06013* as early as possible. Talk-in on 146.28/.88.

INDIANAPOLIS, IN The Morgan County Repeater Assoc. will sponsor the Indiana Hamfest at the Indiana State Fairgrounds Pavilion building. Admission is $7 at the door. 8' Flea Market tables (with space), $12 each. No space will be sold without a table. Set-up Sat. Mar. 9 from 3–9 PM and Sun. Mar. 10 from 6–8 AM. Talk-in on 145.25. For reservations, send SASE before Feb. 23 to *Aileen Scales KC9YA, 3142 Market Place, Bloomington IN 47403. (812) 339-4446.*

MARCH 15-17

ORLANDO, FL The 45th annual Orlando HamCation and Computer Show, sponsored by the Orlando ARC, will be held at the Central Florida Fairgrounds. The Exhibitors Area will be located in a 44,000 square foot air conditioned building. Overnight RV parking at reasonable cost. The Host hotel is The Ramada, Orlando Central at 3200 West colonial Drive. FCC Exams on Sunday at the Ramada convention Center. Complimentary continuous bus service from the Ramada to the Fairgrounds. Contact *Dick DiVittorio KB4QKP, General Chaiman 1991, PO Box 547811, Orlando FL 32854-7811.*

MARCH 16

SCOTTSDALE, AZ The ARCA Spring Hamfest, hosted by the Scottsdale ARC, will be held from 7 AM–4 PM at the Scottsdale Community College. Admission is $2 per car. Swap space $5. Talk-in on 147.18/.78 and ZIA Link. Contact *Allen Sklar AA7BJ, PO Box 10878, Scottsdale AZ 85271-0878* or *(602) 491-0802.*

FLEMINGTON, NJ The Flemington Hamfest, sponsored by the Cherryville Repeater Association II Inc., will be held at the Hunterdon Central Regional High School Fieldhouse from 8 AM–2 PM. Wheelchair accessible. Free parking. Tailgating. VE Exams. Talk-in on 147.975/.375 MHz duplex and 146.520 MHz simplex. Contact *Marty Grozinski NS2K, c/o Cherryville Repeater Assoc. II Inc., PO Box 308, Ouakertown NJ 08868. (908) 806-6944* or *(908) 788-4080.*

MARSHALL, MI The Michigan Crossroads Hamfest, sponsored by the Southern Michigan ARS and the Marshall High Photo Electronics Club, will be held at the Marshall High school from 8 AM–3 PM. Set-up at 6 AM. Tickets $2 in advance, $3 at the door. Free parking. Table Reservations: 75¢ per foot (min. 4 feet) reserved until 8 AM. Send SASE to *SMARS, PO Box 934, Battle Creek MI 49016,* or call *Wes Chaney N8BDM, (616) 979-3433.* License Exams start at 9:30 AM. Pre-registration requested. Include Form 610, SASE and $4.95. Make check or M.O. payable to *ARRL VEC* and send to *Barry Pollack, 330 East Berry Rd., Rives Jct. MI 49277.* Exam charge subject to change.

HUDSON, NH The Interstate Repeater Soc. will hold its annual Flea Market at the Lions Club Hall from 9 AM–3 PM. Set-up at 8 AM. Admission $2. Talk-in on 146.85, 224.46 and 449.625 IRS repeaters. Contact *Wayne Canino KA1MKH, (603) 895-9033.*

MARCH 16-17

FORT WALTON BEACH, FL The Playground ARC will hold their 21st annual North Florida Ham/Swapfest at the Shrine Fairgrounds. Doors open at 8 AM both days. Free Parking. RV parking for $10 per night. Admission $3 in advance, $4 at the door. Swap tables $10 for one day, $15 for both days. Talk-in on the 146.19/.79 club repeater. Contact *Playground ARC, PO Box 873, Ft. Walton Beach FL 32549.*

MARCH 17

MAUMEE, OH The Toledo Mobile Radio Assn. will hold a Hamfest at the Lucas County Recreation Center from 8 AM–5 PM. Advance admission is $4, $5 at the door. Talk-in on 147.27 and 442.85 repeaters. Contact *Bob Hanna K8ADK, 2154 Circular Drive, Toledo OH 43614.*

BRAINTREE, MA The South Shore ARC will hold its annual Flea Market at the Viking Club from 10:30 AM–3 PM. Free parking. Set-up at 9 AM. Admission $1. 8' tables for $10 (which includes one free admission per table), if paid for in advance before Mar. 13. Write to *Hal Jones WB1ABM, 48 Saning Rd., N. Weymouth MA 02191,* or call *(617) 335-5777,* evenings. Make checks payable to the South Shore Amateur Radio Club. Non-reserved tables are $12.

STERLING, IL The Sterling-Rock Falls ARS 31st annual Hamfest will be held at the Sterling High School Field House from 7:30 AM. Set-up Sat. Mar. 16 from 6–9 PM, and on Sun. Mar. 17 at 6:30 AM. Advance tickets $3, $4 at the door. Tables $5 including electricity. Bring your own cord. Talk-in on 146.25/.85 W9MEP repeater. Contact *Sue Peters, Sterling-Rock Falls ARS, PO Box 521, Sterling IL 61081,* or call AC at *(815) 625-9262.*

MARCH 21-23

WASHINGTON, DC A 3-day hands-on Personal Computer Interfacing workshop will be held at the Virginia Tech campus. Contact *Dr. Roy Jones, (703) 231-5242 or (703) 231-6473.*

MARCH 23

UPPER SADDLE RIVER, NJ A Ham Radio Flea Market, sponsored by the Chestnut Ridge Radio Club, will be held at the Saddle River Reformed Church Education Building. Tailgating $7. Tables $10. Donation $2. Contact *Jack Meagher W2EHD, (201) 768-8360.*

ELIZABETHTOWN, KY The Lincoln Trail ARC will hold its 11th annual Hamfest at the Pritchard Community Center. Walk-in VEC Exams (fee $5.25) begin at 9 AM fee $5.25. Show original license and a copy of same. Free parking. Security provided. Set-up starts at 6 PM the night before. Advance tickets $4, $5 at the door. Vendor spaces are $5 each (includes one table and one chair). Talk-in on 146.52 and 146.38/.98. For reservations contact *Whitey Hensley WD4GDA, PO Box 342, Vine Grove KY 40175. (502) 877-2234.* Send check or money order and a SASE. For info call *Chuck Strain AA4ZD, (502) 351-1715.*

MARCH 24

TRENTON, NJ The Delaware Valley Radio Assn. will sponsor Hamcomp '91 at the New Jersey National Guard 112th Field Artillery Armory, Lawrence Township, from 8 AM–2 PM. Free parking. Wheelchair accessible. Advance tickets $3, $5 at the door. Indoor selling spaces are $15 (wall space) or $10. Outdoor spaces are $8. Sellers must provide their own tables. Set-up at 6 AM. Talk-in on 146.07/.67. Contact *Hamcomp '91 c/o KB2ZY, 33 Bowne Station Road, Stockton NJ 08559.* Please SASE.

MADISON, OH The Lake County ARA will hold their 13th annual LCARA Radio/Computer/Electronic Hamfest at Madison High School from 8 AM–3 PM. Admission is $4. Indoor fox hunt will be at 1 PM on 2 meters. VE Exams begin at 8:15 AM and cost $5.25. Tables: $5/6', $6.50/8'. Talk-in on 147.81/.21 and 222.90/224.50 (PL 141.3). Contact *Roxanne, Lake County Hamfest, 5777 Fenwood Ct., Mentor-on-the-Lake OH 44060.* Phone *(216) 257-2036* from 6–9 PM weekdays or 10 AM–4PM weekends, or *(216) 352-6756* 10 AM–4 PM weekdays.

MARCH 30

TEXARKANA, TX The Four States ARC will sponsor its second annual Swap Meet at the Four States Fairgrounds at Loop 245 and I-30, beginning at 8 AM. Admission $1. Tailgate party with cover available if WX is bad. VE Exams at 1 PM. Talk-in on 146.62 –600. Contact *Travis Bailey K5AVH at (903) 792-2080.*

SPECIAL EVENT STATIONS

MARCH 2-3

OPP, AL The Covington ARS will operate Station KZ4S from 1400Z Mar. 2–0200Z Mar. 3, to commemorate the 32nd annual Opp Jaycees Rattlesnake Rodeo. Frequencies: 25 kHz up from the General 80, 40, 20 and 15 bands and approximately 28.385 on Novice 10 meter band. For commemorative QSL and brochure, send QSL card and business size SASE to *C.A.R.S., c/o Kay B. Ezell N4VJI, PO Box 244, Opp AL 36467.*

MARCH 8-10

SWEETWATER, TX The Nolan County ARC will operate Station WR5B from 1500Z–2400Z Mar. 8–10, during the world's largest rattlesnake round-up. Frequencies: 20 and 40 meter General phone bands plus 10 meter Novice. For certificate send QSL and large SASE to *WR5B, PO Box 825, Sweetwater TX 79556.*

MARCH 16-17

ST. PATRICK, OH The Farout ARC of Dayton will operate Station WB8SMC/8 from 1700Z Mar. 16–1700Z Mar. 17. Frequencies: Lower halves of: 80, 40, 15, 10 meter Novice CW and 10 meter Novice phone; 80, 40, 20, 15 meter General phone. Send a business size SASE to *Farout ARC, PO Box 9181, Dayton OH 45409-9181.*

PISCATAWAY, NJ The Piscataway ARC will commemorate the historic Voice of America relay station, WBOU, that operated in Piscataway from 1942–1964. PARC members will operate using their own call signs/VOA from 000Z Mar. 16–2400Z Mar. 17, in the lower General portion of 75, 40, 20, and 15 meters, and the Novice 10 meter band. For certificate, send QSL and 9x12 SASE to *PARC, Attn: KB2UV, PO Box 1233, Piscataway NJ 08854.*

MARCH 23-24

The Virginia Beach ARC will operate Station WA4TGF from 1400Z Mar. 23–2000Z Mar. 24, to commemorate the 100th anniversary of the arrival of the Norwegian Lady to our shores. Frequencies: 3.875, 7.275, 14.275, 21.275 and 28.363 MHz. A certificate will be available to all amateurs contacted. Send QSL and SASE to *VBARC, PO Box 62003, Virginia Beach VA 23462.*

Number 28 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

14.313 MHz

I happened to scan by 14.313 MHz the other day, and I couldn't believe what I heard. The same people who were demonstrating their ignorance over two years ago are STILL on that same frequency. . . arguing the same stupid points . . . being QRMed by the same idiots . . . blah blah blah. . . yak yak yak . . . yawn, yawn.

I have managed to keep my nose out of this little ego battle, figuring that as soon as the participants got bored they would move on to other pursuits befitting their intelligence—like finger painting. Sure, I've mentioned in passing how dumb the whole thing is, but I haven't really addressed the issue directly. The thing that has bothered me the most about the whole ridiculous mess is that it takes up a good chunk of the 20m phone band, which keeps the rest of us from using those frequencies for more productive and enjoyable purposes. I also get a bit angry every time I remind myself that this demonstration of idiocy on the part of American amateurs is being monitored by people all over the world. Some of those foreign listeners will remember what they've heard from the U.S. hams when it comes time to ask for favors at the next WARC. I have also spent a little time considering the example these brainless wonders are setting for newcomers or potential hams.

I went so far as talking to one of the participants a few months ago. I wanted to see for myself if this guy is as big a fool as he appears to be. Yup. . . he is.

I've sought out and listened to the so-called bulletins. Total tripe.

I've even spent several hours just monitoring that portion of 20m, where most of this crap is displayed. I've listened to all sides. I've heard hour after hour of non-identified, intentional QRM.

I've heard virtually everyone who considers himself involved in this mess and what they have to say.

Here's what I've discovered . . .

What we have here, ladies and gentlemen, is a small group of very lonely people. The biggest thing in their life—THE BIGGEST—is the small bit of attention they are able to capture by being pompous and boring on 14.313 MHz. These peoples' lives are so utterly devoid of anything even remotely worthwhile, they have resorted to the only thing they know to justify their existence. They have created a situation, and placed themselves at the focus of it, for no other purpose than to give themselves a reason to get out of bed in the morning. Instead of working constructively and through proper channels to correct what they see as a problem on the amateur bands, these self-appointed keepers of the radio truth have personalized their disagreements. They're not interested in solving problems. Their only motivation is ego gratification. These are true outsiders, folks. The kind of geeks that even the nerds won't associate with. It's funny how important something can become, when the rest of your life is so unimportant.

Try to look at this situation as if you had just come across it today. What would your reaction be? I have explained the conflict to several people who were totally unaware of the whole thing. Every single person had the same response: "Aren't there more important things in the world to spend time and energy on?" All of my non-ham friends who have asked for an explanation of the utter foolishness they hear coming out of my speaker have simply laughed. They're not just laughing at those heard on the radio, they're laughing at the entire amateur radio community for letting such a stupid situation take up so much time, thought and energy. They're laughing at you and me, friend. I can't say that I blame them.

So. . . what's the solution? True to form, the ARRL's response was something like, "We're not involved. It's not our problem." So much for the self-appointed voice of American amateur radio.

The FCC, trying to allow us to fulfill our promise of being "self-policing," has asked those involved to work out their differences. Since those involved have no interest in working out their differences, this has had no effect. Remember, these bozos are getting a barrelful of self-importance out of this. They have actually convinced themselves that what they think is important—enough to cause the inconvenience of thousands of amateur radio operators around the world. Even though the FCC has warned us that if they have to step in to solve the problem they will do so by a swift and privilege-revoking rule change, all the participants can do is continue to bother the FCC with their petty grievances. In frustration, the FCC has stepped up their monitoring and started to levy some stiff monetary penalties (though I haven't heard of anyone who has had his license revoked). The operators who have received fines are wearing them like a badge of honor, further proving their utter stupidity.

One thing that we all can do is make sure we are not providing an audience for these clowns. (This is why you will notice that I haven't mentioned anyone's name or callsign. I know who they are, but I simply refuse to feed their egos by printing their names or callsigns.) If you are monitoring the frequencies, you're part of the problem. If you're monitoring the frequencies AND throwing in an unidentified comment every now and then, you are causing intentional interference.

If you've spent any time around children you know that they will do almost anything, including misbehave, to get an adult's attention. Sometimes the best thing an adult can do when a child is misbehaving is leave the room until the child discovers that his bad behavior will not be rewarded by the attention he craves.

That's what we have here. We have a small group of children who are displaying their desperate need for attention. If we continue to give it to them, we are just reinforcing their behavior. If we all could just leave them alone, they would eventually discover that nobody's listening. Nobody cares. The adults have left the room. 73

Number 29 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Almost Excellent

You may expect the usual conditions that prevail around the equinoxes when the ionosphere recovers from its winter doldrums and becomes active again for HF DXing. Since we are slightly past the peak of sunspot Cycle 22 and beginning the slow decline in solar activity, conditions will be excellent. However, they might not be quite as good as conditions during this month in 1989 and 1990. That is, solar flux may be down a bit compared to those two years, and there are likely to be more fair (F) than good (G) DX conditions (see the calendar below).

You can always determine when to operate under the best possible conditions by using three sources of information: the daily propagation forecast chart, the band-time-direction chart, and WWV at 18 minutes after each hour. With these sources, you can pick the best possible times to work that DX you are looking for.

In general, the first two weeks are expected to have better conditions than the last two weeks. But, as usual, there will be occasional good (G), fair (F), and poor (P) days intermixed.

A good (G) day will show low planetary "A" indexes (below 10 or so) when the magnetic field is quiet, and a relatively high solar flux of, say, 175 or more. Increasing magnetic "A" indexes and declining solar flux will mark the fair (F) or poor (P) days for you. One advantage of these days and nights of equal length is the opportunity for excellent gray-line propagation along the paths of dawn and dusk around the world. Use these times to your best advantage. 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20	20	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20	—	—	15	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40	40/80	40	—	—	—	—	—	15	15	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15	15/20	—	—	—	—	—	15/20	15	—	—	—
JAPAN	10/15	15	20	20	20	—	20	20	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	10/15	—	20	20	—	—	—	—	10/15	10/15	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R	—	—	—	—	—	—	—	15	15	15	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/40	20/40	20/40	—	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15	20	—	—	—	—	—	15/20	15	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	20/40		—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	20/40		—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R	20	—	—	—	20	—	—	20	20	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days (1) Possible opening on this band on "G" days (2) Try 80m
Note A: Use values of 10/15 for 12m, 20 for 17m, 40 for 30m. Note B: This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

MARCH 1991

SUN	MON	TUE	WED	THU	FRI	SAT
					1 G	2 F
3 F-G	4 G	5 G	6 G	7 G	8 G-F	9 F
10 F-P	11 P	12 P-F	13 F-G	14 G	15 G	16 G
17 G-F	18 F	19 F-P	20 F-P	21 F-P	22 F-P	23 P
24 P-F	25 P-F	26 P-F	27 P-F	28 F-G	29 G	30 G
31 G						

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LETTERS

From the Hamshack

Lyndon Taylor N6UCE, Yorba Linda CA As a person who does a considerable amount of reading on a variety of subjects, including amateur radio, and as one who finds himself frequently on the "opposite side" of most modern opinions of social, education, and political "truth," I want you to know how much I appreciate your columns in *73*. I say this not because you generally mirror my opinions, but because of the clarity of your presentations and your obvious conviction about what you are saying! Case in point: The December 1990 issue, where you discuss both the ARRL and the joys of being an entrepreneur. In about three paragraphs, you have presented an eloquent description of the motivation of the entrepreneur, the "adventure" of pressing an idea forward, not for money, but for the personal reward of seeing an idea that you have had become an operational reality. I can't think of anything more exciting than that, and you have stated this case beautifully.

73 Magazine is certainly more than a magazine about ham radio. It is a statement about life, about enthusiasm, and about the pursuit of excellence.

In the same issue there is an absolutely superb column by David Cassidy N1GPH on "magic." David captured the essence of why many of us entered into ham radio. It *is* magic when I walk out in my back yard and see a piece of wire stretched across the sky and know that a few hours ago it allowed me to talk to a research biologist in Antarctica over 8,000 miles away. Just as it was magic when, as an 8th grade student in the late '40s, I strung together some tubes and wire and ultimately produced a functioning television set.

The rest of your magazine is loaded with good articles about radio, and numerous ads about products and services of value to the amateur. Thank you again for your excellent writings and publications.

Art Oates, Jr., K9GBN, Pekin IL Read your article reviewing the Kenwood 27A. This radio, as you said in your article, looks nice; but that is as far as it goes. The radio has no selectivity on an outside antenna. Kenwood admitted twice to me on the phone that on an outside antenna selectivity is bad, and said that all handhelds are bad that way. I told them to use the ICOM micro or Heath micro because they don't pick up paging and weather bureau 20 miles away. It is the design in their radio which gives it bad selectivity. If you had read the schematic, you would have seen the problems they have with the selectivity.

Also, you didn't mention that it has a bad overheating problem. Could that be why, as yet, they haven't come out with a quick charge and 12 volt battery? My advice—don't operate the radio too long on 12 volts or you will have more problems with the 27A. Kenwood won't say when they will come out with a 12 volt battery or quick charger.

I didn't mention a problem with the TH-27A's selectivity because I didn't experience one. I have operated the radio in many urban areas, including the RF-saturated Northeast, and I have not found the selectivity any worse than that of other HTs. Current HTs, capable of receiving a much wider frequency range than older models, do exhibit worse selectivity than previous models (such as the old IC-2AT), but this is a problem shared by all HTs. To single a Kenwood HT out for this would be grossly unfair.

The same holds true for what you call a bad overheating problem. When you operate any *modern HT at 5 W output for any length of time, you are going to get some serious heat! To imply that Kenwood's HTs are the only models to heat up at high power wouldn't be accurate. By the way, a quick charge* is *available. It is listed in the TH-27A instruction manual on page 48. Kenwood tells me that a 12 volt battery is to be released soon. . . . David N1GPH*

Sandra M. Hawley N5OLU, Houston TX I resent both the snide tone of your "Flaplet" item in the February "Never Say Die," and your inflammatory misstatements about what happened at the Houston Ham Com.

First, the "mad" ARRL officials you referred to were members of the Clear Lake Amateur Radio Club. We were at the Ham Com because the organizers of the convention had asked us, for the third consecutive year, to run the ARRL booth for them.

Second, we weren't "steamed" because we had been refused free passes for the vendor area. In fact, we had badges that gave us access to the vendor area all day. The Ham Com officials gave us those badges, as they had in previous years, because the ARRL is classified as a "vendor" at the convention.

Third, our members did not "sneak into" the paid area and get caught "red-handed" by vigilant Ham Com officials. They put on the badges, said hello to the guards, as they had earlier, and walked in with official permission, as they had earlier.

Fourth, we did not "still refuse to buy tickets." We were never told that we should buy tickets at any point. The Ham Com officials simply marched up to the CLARC members and told them (us) point-blank to get out—this desipte the fact that CLARC was there at *their* request, wearing the badges that *they* had given us!

Furthermore, our members scarcely qualify as "bullies." One of the CLARC members who was treated so rudely was the 1990 AEA Amateur Ambassador of the Year—an individual who has made, and been recognized for making, major contributions to amateur radio. The other "sneaking bully" was a long-time amateur, elmer to many in the Houston area, and father of the winner of the 1988 Hiram Percy Maxim Award.

I have enjoyed my involvement in amateur radio, and I had enjoyed helping out at the ARRL booth. It seemed a good way to return at least some of the benefits amateur radio has given me. After this mess, I find it hard to keep up my enthusiasm for the Houston amateur radio scene at a high level. And I damned sure won't be volunteering to help at the Ham Com again.

Finally, I am appalled to find such slipshod reporting in your column. Like many others, I have often enjoyed your iconoclasm and even a bit of "ARRL-bashing." Now, having been at the other end of the bashing, I must wonder how many of your previous comments have been as inaccurate and injuring as those in the "Flaplet."

Ahh, the flaplet is being fanned into a full-sized flap! Sandra, my item came solely and totally from a report put on an ARRL BBS by the members you are defending, not the Ham Com people. Rashomon! . . . Wayne

Bob Minton NU7L, Boise ID Kudos for your stand on the problems in amateur radio. Let me add a thought or two concerning American manufacturers. I just canceled my dealership yesterday with one very well-known publisher because of their poor service. They turned down a thousand dollar order just because of their all-too-typical American snotty attitude about doing business. They are not the first company I have refused to do business with because of problems.

American manufacturers are curious as to why we have a 100 billion plus trade deficit each year. I can tell them, as I deal daily with overseas and domestic importers. Manufacturers from Hong Kong and Taiwan want my business and accommodate me as much as possible; American companies are too hung up on producing balls of red tape and nonsensical corporate idiosyncrasies for me to deal with. Until Americans get back to good old-fashioned customer service instead of dreaming up new ways to stop the flow of products, the U.S.A. is going to be nothing but a consumer country.

I hope some of the people in the electronics industry read this and take a hard look at their operation. Get rid of the placid, whiney sheep you have hired as employees and give us people who can converse intelligently over the phone. And for goodness sake, hire people who can make a decision on their own without having to check with everyone from the shipping clerk to the corporate washroom attendant.

Bob, when you're right, you're right! Every book you read on how to run a successful business stresses customer service. But getting this message through to employees can be almost impossible. We need a revolution in our whole American educational system. How are we going to teach youngsters who are given supermarket toys that break within minutes about quality? How are we going to teach Americans, who happily buy Detroit cars, to even understand the concept of quality? . . . Wayne

T.S. Rowinski KA1MDA I follow your editorials very closely, and for the most part agree with all of them. I feel, though, that you are missing one major contributing factor for the decline of the American consumer electronics industry: customer service/respect. It has been my experience that the Japanese companies treat me with respect and courtesy, regardless of how small the order. The American companies, on the other hand, give me the impression that I'm keeping someone away from their coffee break!

As an example: When my five-year-old IC-2AT HT broke down, I located the defective part and called ICOM. In no time, I was transferred to the engineering department. I described the location and function of the part, and the engineer found the part number and gave it to me. When I called the parts department, I was informed that it fell below ICOM's minimum order amount. The woman asked me if I was sure I didn't need anything else. When I replied no, I was informed that the part would be sent to me free of charge! Three days later, the part arrived, and my 2AT was back on the air that evening.

Now let's take a look at G.E. At a hamfest, I purchased a three-year-old shortwave radio manufactured by G.E. Six months later, the BFO pot went bad. I wrote G.E. a letter and received a reply four months later stating that G.E. did not sell parts to consumers, and if I wanted my radio fixed, I would have to send it in to their repair depot. I managed to find the G.E. HELP phone number, and they gave me the name and number of a parts depot. To make a long story short, the parts depot couldn't sell me a part unless I gave them the G.E. part number, and G.E. wouldn't give me the part number unless I bought the service manual! Final tally: To obtain a 50k ohm, linear taper pot, it took 7 months, 1 letter, 5 phone calls, and $32 for the manual! I'm still waiting for the part, though. . . it's on back order.

Whose products do you think I'll buy in the future? Sure, I wish I could "buy American," but I'm not going to pay premium prices for products from manufacturers who don't want to be bothered dealing with me ten minutes after my cash is in their pockets!

Jim Blizzard AB4YC Just finished reading your "Never Say Die" column in the February issue. In it, you state: "We need to do something to revive an interest in CW. . . . The voice bands are busy and the CW bands are oddly vacant." You then ask us to count the number of CW frequencies in use.

You write this shortly after you finish telling how harmful CW is to the human body. What gives? If you, yourself, are "going to steer well clear of Morse, both receiving and transmitting," why shouldn't we?

I enjoy CW quite a bit, but after reading your column, I have decided to hang up my keyer. I am sorry to read that CW may be dangerous to my health, but I thank you for being courageous enough to publish this information.

If hams heed the warnings about CW, it seems that the CW bands will become even more deserted. Keep up the good work. . . and see you in the voice bands.

You're right, of course. But keep in mind that I've been warning against cigarettes for over 30 years, and my editorials haven't had a noticeable effect on ham smoking.

If you're interested in knowing more about the enormous complexity of cells and the electromagnetics involved, you might look for Electromagnetic Man, *by Smith and Best (1989). It's miserably written, but the information, once it's picked out, will be most disturbing for hams.*

It's interesting, too, if you're into understanding how life works, to read Origins, *by Shapiro. I've just read both books and found them fascinating.*

So we have to deal with both the real world. . . plus strive for the more ideal world, where people avoid potentially destructive forces. . . . Wayne

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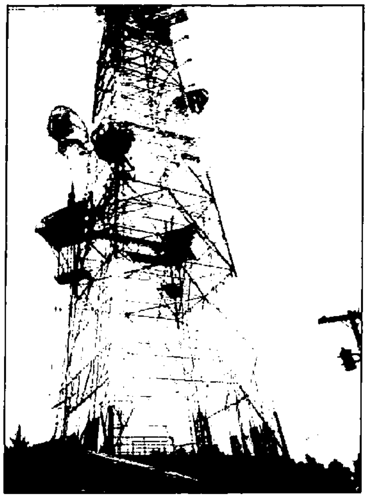

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Contract: By reading this fine print you have hereby legally bound yourself to try one new facet of amateur radio in the next 30 days. Are you on packet? If not, pick up a TNC and check it out. How about RTTY or AMTOR? You'll meet some pretty friendly hams on these modes. Even the DX will rag-chew. Have you tried microwaves? How about amateur television? When's the last time you home-brewed something? The *73* advertisers can supply you with whatever you need. . .just don't forget to tell 'em *73* sent you.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

First UPS, Now Apple!

You've probably read about Apple asking the FCC to set aside 40 MHz for a computer communications system. Well, I predicted in an editorial that such a network would inevitably have to be developed, so this isn't any big surprise. I'd hoped that we hams would be the developers, just as we pioneered today's cellular telephone system.

But just as technology had passed UPS by with their compandered SSB dreams, which we hams tried and found seriously wanting, I suspect that the Apple people who threw this one into the FCC's input basket didn't do their technological homework. Of course we hams shouldn't be ones to talk. We're still fussing over the code, which has been technologically dead for over 40 years. Alas, even with voice communications, in this great digital age we're still hanging tough with analog. It's sadly reminiscent of our "Spark Forever" stance in the late '20s and our resistance to SSB in the late '50s.

But it seems to me that a computer company should be able to come up with something better than a technology which requires 40 MHz for intercomputer communications. Tsk. Ain't you heard about spread spectrum, kiddos? Oh well, we hams haven't either. Not really.

Oh, I agree that with the world finally moving to laptop and notepad computers, having to plug wires into 'em doesn't make sense. They should be able to access networks, hard drives, data bases, large screen displays and printers without umbilical cords. And they will. They will.

Sure, we can assign separate channels for every computer at a site and do this the brute force way. It'll be easy to build in a tiny communications module which can interface with a repeaterette within a hundred feet or so. Then these repeaters can be linked via cable, telephone or even satellites to the world. . .as well as local support systems. Ooops, there's a message just in from Compuserve. . .and another via Prodigy. I can tell by the little blinking "C" and "P" on the bottom line of my notepad computer screen. Just a second. Oh yes, some chap in India says the band is open to my area and he wants me to get on 14.210 for a QSO. Yep, there he is. . .nice signal, too.

With spread spectrum we should be able to interlace zillions of computers, all in a much smaller frequency band than 40 MHz. Our communications will be infinitely more secure, too. And since any band they set aside for the Apple corps will probably eat into the nearest ham band, we have a strong vested interest in beating Apple and the FCC back with a technological stick.

No, I don't expect you, as an individual with no real interest in the frequencies we'll probably lose, to take the time to write to Apple or the FCC and express your concern. After all, it isn't your ox that's being gored. Nor do I expect that you'll bring this up at a club meeting and ask the club secretary to write to Apple and the FCC expressing a group concern. Nor would I expect anyone visiting an Apple dealer to say anything. Nor do I expect to see much mentioned about this in ham club newsletters. Nor do I expect to see the ARRL take a leadership position on this very small matter. Nor do I expect that my expectations, which are minimal, will be exceeded.

Yes, I rail out against this and that, but please do not convince yourself that I honestly expect to see any real changes. Oh, sure, I have hopes. But I'm used to changes coming slowly.

I started pushing for a no-code ticket in 1958, as I recall. At that rate of progress, I'm not likely to live to see another major change in amateur radio. I've already used up most of my allotted three score and ten and we're talking genuine glacial-speed changes. Despite my enthusiasm for new ideas, I do have one foot rooted in the real world, so, as I revealed above, my hopes are high and my expectations are low.

Will the League sue the FCC over the no-code ticket? Maybe they should start a new campaign to get donations to fund the League lawyers in these expensive attempts to further alienate the FCC. Oh, oh. . .there I go offending the delicate sensibilities of the true ARRL believers. Darn it, I wish I'd stop doing that. There's already talk of an anti-Green League jihad for blaspheming The Faith. Make a little more room in your cave, Rushdie.

Will no-code be as bad as many negative-thinkers are saying? Of course not! Will it be as great as starry-eyed optimists are preaching? Baloney! Will it start swelling our ranks and reversing our loss of newcomers? Well, I have good news! The word is just in: A chap in Albuquerque has come aboard as a no-code Tech. Gentlemen (and YLs too), we have a new licensee. I was going to say, "Rahl," but our new ham is Hispanic, so let's say, "Ole!"

As a gourmet chef I'm known as the Kitchen Cynic (call me KC for short), so I try to keep my gullibility on short tether. Even so, there are already some rays of hope that no-code will help. Like a late flash from Silicon Valley's W6NLG saying their new VEC session pulled 57 candidates, up 170%.

K1MAN Update

As if we haven't been having enough trouble with KV4FZ and his group making a mess out of the high end of 20m, now we've got K1MAN lousing up 14,275 with endless self-congratulatory broadcasts. The FCC has tried to shut him up with official citations and fines. Apparently K1MAN has substantial resources, so he's embarked on a plan to enrich both his and the FCC's legal teams, all to the detriment of amateur radio, in order to keep his microphone open.

I guess, as long as we only have Baxter and the ARRL sending blind transmissions on our bands, we can live with losing two channels. But what if there turns out to be more hams who want to broadcast?

I can understand W1AW's broadcasts. They're desperately pushing for more *QST* subscribers, so they need to advertise in every way they can (under the guise of public service, naturally). Having met and talked with Baxter, I can understand why he's broadcasting—and willing to spend whatever it takes to continue.

I hear he's pushing hard to take over the American WARC team next year. I've been trying to think over all of the hams I've met or talked with to see if I could come up with someone who I'd like less to see representing America at WARC. I've failed so far, but I'll keep thinking.

Now, I may come across in my editorials as opinionated. I like you to think that, even though I chuckle when I get letters complaining. If I let things really bother me the way I pretend, I'd have been dead years ago. With that in mind, I want to tell you about a phone conversation I had with Baxter. Well, "conversation" isn't quite accurate.

In my entire life I don't think I've hung up on more than two or three people—and the others were insurance salesmen. With Baxter I found myself faced with a close approximation of listening to his broadcasts. Nothing I could say or even shriek stopped him. I finally gave up. He almost made me mad.

With this background you may be able to imagine my reaction when I read in a ham newsletter that Baxter was bragging that he had sent a ham delegation to Baghdad to try and work out a peaceful solution between the U.S. and Iraq with Saddam. I thought, what kind of idiot have we got here?

Efforts to corroborate that this peace mission was anything more than a figment have not borne fruit. If it's true, then Baxter put several hams into terrible jeopardy. It's also, of course, completely illegal for private citizens to deal with foreign governments on behalf of the U.S. But Baxter was mixing in with U.S.-Soviet dealings, so who knows?

The War

It's nice that the FCC hasn't put us off the air during our last three wars. I still remember hearing about Pearl Harbor during a 160m QSO that long ago Sunday on December 7th. And I remember amateur radio being closed down the next day, with W1AW going after hams who pretended not to have heard about the ban. We were off the air for four years.

I'd been retired after five busy submarine war patrols and sent back to New London to teach electronics when the war ended. That same day I got on 2m, the first band they opened, from my school lab and made several contacts. I spent many nights on a hill in the submarine base with a little home-made transceiver, talking with local hams. It was a little long-lines 1G4GT/1Q5GT rig I'd built from an article in *Radio* in 1939.

After the Korean and Vietnam wars there wasn't a lot for us hams to do. But this new war is a little different, so I see an opportunity for us to provide a real and needed post-war service.

There are hundreds of thousands of people in the U.S. with friends and families in Iraq and they're going to be frantic to find out how things are at home. The military can't possibly cope with this level of health and welfare traffic. It'll probably be months to years before the telephones are working dependably again. That kinda leaves us, doesn't it?

We're going to need some volunteers to hit the decks running, so to speak. We're going to need several ham stations to be set up in Baghdad and the other major Iraqi cities to provide the communications which will be needed. If you are interested in spending a month or two on such a project I'll see what I can organize in the way of transportation.

Continued on page 86

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EDITED BY LINDA RENEAU KA1UKM

The End of Packet?

Last January, eight amateur packet operators were fined $300 each in Notices of Forfeiture, and three others received Notices of Violation of Part 97, according to the Norfolk, Virginia, FCC Engineer in Charge, J. Jerry Freeman. The offending message, dated January 5, 1991, stated: "From: wa3qns@n3la.pa.usa.na (JOE); Message ID: 21035–N3LA; TO: all@allbbs; SUBJECT: Call This Number, ASAP; VOTING BY PHONE - PHONE 1-900-44-NO WAR!; Conf: mideast gulf; Coalition to Stop U.S. Intervention in the Middle East (October 20 Coalition); 36 East 12th Street, 6th Floor, NY, NY 10003; Phone (212) 254–2295; Fax (212) 979–1583; December 7, 1990—The coalition has a national '900' phone number to tell Bush 'NO WAR.' The number is 1-900-44-NO WAR (starting Dec. 16). Please use it. A record of each call, by area code and region, will be taken with the petitions to Washington. You may contact the coalition for stickers and flyers to publicize this number, plus copies of the petition for a million signatures against the war, and other organizing literature."

The original complaint was registered by U.S. Navy officer Russell P. Tjepkemal/NZ2D of Virginia Beach, who said, "This message violates the spirit of amateur radio in that it has always been considered inappropriate to use amateur radio to further political causes." NZ2D also pointed out that the message did not mention the $10 fee for calling the 900 number. FCC rules prohibit the use of amateur radio to facilitate the business affairs of any party, whether for profit or not-for-profit.

According to AMSAT President Emeritus Tom Clark W3IWI, the citations ". . . may well spell the end to much of amateur packet radio." Clark was one of those cited by the FCC. Also among the cited were N4HOG, WB0TAX, WA4ONG, WA3ZNW, KA3CNT, WA3TSW, N3LA, and WA3QNS.

This appears to be the first time that the Commission has enforced the rules against operators of packet stations who retransmit an allegedly violative bulletin originating at another station. A debate has raged for years over whether operators of intermediate stations in a packet network should be held responsible for compliance of retransmitted messages.

Sysops and users of packet BBSs are confused or furious about what to do. Here are some typical statements seen on packet systems around the country: "I must now HOLD ALL TRAFFIC through this board until I have reviewed it for my own safety. . ." "This is a VERY BAD SIGN! If this is upheld, my BBS may have to be shut down, as I cannot review every message, or even every bulletin, that passes through it." "I want to make public. . .that this BBS. . . now screens all bulletins. . ."

W3IWI aired the most extensive response. He says, "The implications of the action by the FCC's Norfolk Field Office are absolutely appalling. What is implied is that. . .every station in a store-and-forward network is responsible for the actual message CONTENT passing through each node. The BBSs were cited because their calls were in the message header 'audit trail.' The FCC's action states that each BBS SYSOP is personally responsible for the 'correctness' of all messages merely passing through his system. Here, the W3IWI mail switch handles about 10,000 messages per month automatically. There is NO WAY I can vouch for every bit that passes through!"

Another consideration, says W3IWI, is PACSAT, ". . . a flying BBS with the sysops on the ground. To screen out 'offensive' messages, a ground-based sysop has to use a radio channel to verify message CONTENT. But the FCC letter says that the very act of reading an 'offensive' message on the radio is illegal. . . the logical implication is that PACSATs must be turned off!

"A number of us have discussed such issues with responsible individuals at the FCC in Washington ever since the first fledgling days of packet radio. The signal that the FCC sent was that the sole responsibility for the CONTENT of a message lay with the ORIGINATOR. The actions of the Norfolk Office seem to indicate a new policy has been adopted which effectively kills packet radio." *TNX* W5YI Report, Vol. 13, Issue #4.

Get Ready for STS-37!

The next SAREX (Shuttle Amateur Radio EXperiment) mission is currently scheduled to lift off on April 4 at 1420 UTC. Onboard the *Atlantis* will be the first all-ham crew: Ken Cameron KB5AWP, Jay Apt N5QWL, Linda Godwin N5RAX, Steve Nagel N5RAW and Jerry Ross N5SCW. They plan to operate on voice, packet, SSTV and ATV during the five-day mission. When the crew is busy with other duties, the packet robot (similar to STS-35) should be operational. Please note that it's only necessary to receive a QSO number from the robot to qualify as a valid contact. However, it's important to send in a copy of your contact for a QSL.

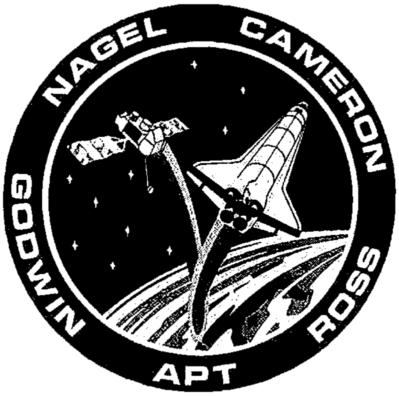

Photo A. The STS-37 crew insignia, designed by crew members. The shuttle and Gamma Ray Observatory (GRO) are connected by a large "gamma" symbolizing both the quest for gamma rays and the importance of the relationship between the manned and unmanned elements of the space program. Can you find the reference to our magazine's logo in the insignia?

The SSTV downlink should provide us with some spectacular views. Look for this mode during spacewalk activities, and in particular during the release of the Gamma Ray Observatory (GRO). During the scheduled school contacts, the astronauts plan to send down occasional SSTV pictures directly to the students.

Only a few stations, primarily at the NASA space centers, have been approved for the fast-scan ATV uplink experiment. If this is successful, it will be the first time any fast-scan video has been uplinked to any U.S. manned spacecraft.

An *Atlantis* to *Mir* contact is likely to be attempted. *Thanks to Roy Neal K6DUE, Bill Tynan W3XO, and Lou McFadin W5DID for the above information.*

FREQUENCIES TO BE USED FOR THE STS-37 SAREX MISSION

Mode:	Downlink Freq. (MHz)	Uplink Freq. (MHz)
Voice or SSTV:	145.55	144.95
		144.91 & 144.97 alternates
Packet:	145.51	144.91 MHz
		144.93 & 144.99 alternates

For SAREX updates during the mission, listen to the following transmissions:

WA3NAN (Goddard): 3.860, 7.165, 14.295, 21.395, 28.650, and 147.45 MHz.
W5RRR (Johnson Space Center): 3.850, 7.227, 14.280, 21.350, 28.495, and 146.64 MHz.
W6VIO (JPL): 14.270, 21.340, and 224.04 MHz.
K6MF (Bay area): 3.840, 7.165, and 145.58 MHz.

VE Improvements

The ARRL has made changes in its Volunteer Examiner Coordinator (VEC) program. The League will now permit its VE teams to retain up to $4.00 of the $5.25 exam fee in order to offset expenses in-

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curred locally. This should make it possible for VEs to schedule examinations more frequently and receive more publicity in their areas. The League will continue to provide its VE teams with the traditional services free of charge.

VEs may now telephone the ARRL VEC via a toll-free number: 1-800-9-ARRL-VEC (or 1-800-924-7583). Overseas VE teams should contact the ARRL VEC for information on how to access the number from their locations.

VEs who have been active in other VEC programs, and whose accreditation in another program is current, are now able to apply for "instant accreditation" as ARRL Volunteer Examiners.

By April 1, VE teams who prefer to use their own computers to generate exams will be able to do so. Also, teams preferring a multiple-choice format for Morse code exams will be permitted that option.

"As a result of the code-free Technician license, the demands on amateur radio Volunteer Examiners will be very heavy in the coming months," says ARRL Executive Vice President David Sumner K1ZZ. "We want to give our VEs the best support we can during this critical period. We also want to make sure that anyone seeking an opportunity to take an exam won't have far to look." *TNX ARRL. The above was excerpted from an MCI mail news release dated Feb. 13, 1991.*

Photo B. The Committee for the Electronic and Radio Communication Center (ERCC) of the Science Museum of Long Island, left to right: Mike W2KO, Kate AE2Z, Sid K2LJH, Bill KA2OVR, Ed W2KPQ, and Alex AI2Q. Not present are Milt W2ERJ and Herman W2TLC.

Moonbase America

On April 16, 1991, 80 high school students will enter "Moonbase" next to Copley High School in Copley, Ohio, for a seven-day simulation. During that time, they will run their own government, eat food growing inside Moonbase, perform experiments, attend classes through a video link, and turn in their homework by FAX. All radio communication will be via amateur radio. Twenty students will be equipped with HTs, and the Communications Center in the Main Dome will house several amateur radio stations for OSCAR, packet, VHF/UHF, voice, ATV, and the low bands. Mission Control Center in the high school auditorium will be similarly equipped. Selected schools in each state will also participate in the simulation.

Special event certificates will be sent to stations contacting Moonbase from April 16 through April 22.

These students, from the Fairlawn Middle School and Copley High School, have been attending a state accredited space science class since last September. Part of their preparation included learning about amateur radio. Sixty-seven have obtained their Novice licenses, and with the new code-free Technician license, it's possible many more students will obtain licenses.

The Moonbase America project is funded by local and national corporation grants as well as local fund-raising. Training and technical support has been provided by the Cuyahoga Falls ARC, led by Rich Burgan WC8J, (216) 929-HAMS, and Mike Young WB8CXO, (216) 920-9976. For more information, you may contact Project Director Carolyn Staudt at (216) 666-5015. *Many thanks to WB8CXO for letting us know about this exciting activity.*

Go for It!

During the devastating 1964 earthquake in Anchorage, Alaska, Barbara Carter helped her husband, K6RKG (a silent key) take messages. That's how she became interested in amateur radio. "I found it rewarding to assure families that their sons and daughters were OK." She got her Novice license in 1977; her Technician and General, in 1985; her Advanced, in 1987; and finally, her amateur Extra class license in 1988. "So many people helped me," she says. Some of these people were Dave WØMEY, Nels N6AQY, Mike W6FCQ, and members of the Marin Amateur Radio Club.

Barbara was a violinist in several symphony orchestras. For 14 years, she was director of a women's chorus. Once she sang with Arthur Fiedler in one of his San Francisco Pop Concerts. Today she enjoys doing ceramics.

Her message to potential hams is: "Go for it! Amateur radio is a fascinating hobby—meeting people around the world. Sometimes you make life-long friends...I would like to see more YLs enjoying the hobby as I do." *TNX Vicki Lee Hess W6OAE/T3ØCH, a ham for 35 years herself, and a friend of WB6TPN.*

Photo C. Extra class licensee Barbara Carter WB6TPN likes to work all the bands, but especially 15 and 20 meters. She enjoys both CW and phone.

New Teaching Center

A group of local radio amateurs have established a "New Age" Electronics and Radio Communication Center (ERCC) at the Science Museum of Long Island. The museum, a 22-room mansion on 40 acres overlooking Manhasset Bay, is a non-profit organization that offers staff development workshops, consulting services to educators, and hands-on training for teachers with limited science preparation.

The ERCC, now teaching Novice classes, will expand its program to hands-on training in radio communications, computers, satellite operation, packet, ATV, RTTY, and other developments.

The "Antique Radio and Electronic Section," ERCC's recent addition, are viewed by the many museum visitors. Names of the donors are attached to all items. If you wish to donate equipment, new or old, you can write the ERCC at: Science Museum of Long Island, Attention: ERCC, 1526 N. Plandome Road, Manhasset NY 11030.

Members from the Long Island QCWA, Chapter 81, spearheaded ERCC, with help from members of the LIMARC, Nassau, and Suffolk radio clubs. The Committee for the ERCC consists of: Ed W2KPQ, Mike W2KO, Sid K2LJH, Alex AI2Q, Kate AE2Z, Milt W2ERJ, Bill KA2OVR, and Herman W2TLC. See Photo B. You may contact any of the committee for additional information. *TNX Michael J. Orofino W2KO.*

Artificial RF Ground

Maximize your antenna's efficiency.

by J. Frank Brumbaugh KB4ZGC

The ideal RF ground is having your station equipment mounted in and thoroughly grounded to a metal tub floating in salt water. Ham stations in boats approach this ideal, but the rest of us usually have to settle for considerably less efficient RF grounds. The many hams living in high-rise apartments and condos, even those with their stations on the ground floor of the typical house, have station ground leads many feet long between the equipment and actual ground. While this provides the DC ground necessary for safety, it is seldom an efficient RF ground on all the bands that you normally work.

For instance, many hams consider a few feet of wire or braid run to a nearby eight-foot ground stake a good solid ground. But—eight feet of wire is about a quarter wave on 10 meters, and presents a high impedance at the transceiver/transmitter chassis when the other end is connected to the ground stake or other good DC ground on 10 meters. This is not an RF ground at all, and the chassis will be "hot." If the mike tingles your lips, or if your fingers get "bit" by the setscrews in the knobs, you know you do not have a good RF ground, and you must do something about it.

Any length of wire or braid between your transmitter/transceiver chassis and actual earth ground presents an impedance which raises the chassis above ground for RF. Because ground connections are a part of your antenna system, impedance in the ground lead reduces the efficiency of your antenna system.

A Better Ground

To correct this problem, you can force a low impedance at the transmitter/transceiver chassis by shunting the station DC ground with a wire an electrical quarter wavelength long, open at the far end. Connect the other end to the transmitter/transceiver chassis, with the wire snaked on the floor along the shack wall. This quarter-wave "transformer" exhibits a very high impedance at its open end and reflects a very low—theoretically zero—impedance where it connects to the chassis. This provides a very good RF ground at the frequency at which the wire is a quarter wavelength in length. However, the RF impedance at the chassis, while low, will vary from one end of the band to the other, and is most effective only at the design frequency.

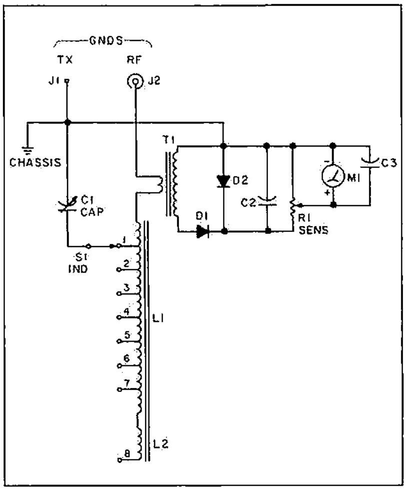

Figure 1. The artificial RF ground.

An eight-foot piece of wire connected to the chassis for an RF ground on 10 meters may be easy to hide, but what if you prefer to work 80 meters? Or even worse, if you like to work all the HF bands? You would need one or more quarter-wavelength wires for each band you normally use—and this can present problems. Few XYLs will tolerate a rat's nest of wires all over the floor, especially if the ham station is not located in a room by itself.

The Artificial RF Ground

This instrument is my solution to the problem of getting a low impedance RF ground on the bands I operate. My station consists of three monoband transceivers running 10 to 25 watts on the 10, 15 and 40 meter bands. It is located on the second floor of a frame house, in my bedroom. (Actually, my bed is in the shack!) My DC ground—a copper water pipe in the bathroom—is 34 feet from the station equipment, and an unknown number of feet from the bath to Mother Earth. I used to use open-ended quarter wavelength wires draped on the floor along the wall for RF grounds, but my cat insisted on dragging them all over the floor in a tangled mess. This made a different approach to RF grounding a virtual necessity.

Circuit Description

The Artificial RF Ground schematic is illustrated in Figure 1. A series circuit, consisting of C1, L1 and L2, is connected between the transmitter/transceiver chassis and a short length of wire which is open on the far end. The chassis, of course, is connected to your DC ground for safety reasons. This series circuit is capable of resonating in all bands between 40 and 10 meters, thus providing a low impedance ground for RF at the transceiver chassis. Current flowing in this series circuit is sampled between C1 and L1 by the primary of T1, and its level monitored on the meter M1. When the series circuit is tuned to resonance as indicated by a peak meter indication, the transmitter chassis is at ground potential for RF.

Theory of Operation

A series circuit consisting of capacity and inductance presents a very low impedance at its resonant frequency. When the transmitter is keyed (on CW, FM or AM) and the chassis is not at RF ground potential, a current will flow in the series circuit of C1, L1/L2 as determined by the position of S1 and C1, and when resonance at the transmitter frequency is achieved, this current will be at maximum. Switch S1 lets you insert varying amounts of inductance in series with C1, depending upon

the frequency in use.

The primary of T1, a step-up transformer, is connected between C1 and LI where the highest current is available. RF current flowing in the series circuit can be sampled, stepped up in the secondary of T1, then detected by voltage doubler diodes D1 and D2, filtered by C2, and applied to the sensitivity potentiometer, R1. The DC voltage across R1 is directed to meter M1, which is bypassed by C3 to eliminate any RF from the meter. M1 will show a peak indication when the series circuit is tuned to resonance at the transmitter frequency.

At this point the transmitter chassis is at ground potential for RF. To ensure the best possible ground, use the shortest possible piece of braid or wire to connect J1 to the transmitter chassis.

Because a series circuit presents an extremely low impedance at resonance, this combination of C1 and L1/L2 and the length of wire which is connected to J2 forms a very low impedance RF ground which is electrically an odd multiple of a quarter wavelength at the operating frequency.

Parts List

C1	365 pF variable capacitor, broadcast radio type
C2, C3	0.01 or 0.02 µF disc capacitor
D1, D2	1N914, 1N4148 or equivalent silicon diode
J1, J2	Banana, pin, RCA jack, etc. (J2 is insulated from chassis.)
L1	36 turns No. 26 AWG e.c. wire on T68-2; tapped at 4, 8, 12, 16, 20, 24 and 28 turns from T1 end
L2	13 turns No. 22 AWG e.c. wire on T68-3 core
M1	100 to 200 µA DC meter
R1	10k linear potentiometer
S1	Wafer switch, 1 pole, 8 positions
T1	36 turns No. 26 AWG e.c. wire on T68-2 core; primary 1 to 3 turns insulated hookup wire

Suppliers

Amidon Associates, P.O. Box 956, Torrance CA 90508. (213) 763-5770. (Toroids.)

Fair Radio Sales, 1016 E. Eureka, Box 1105, Lima OH 45802. (419) 227-6573. (365 pF variable capacitor.)

Radiokit, P.O. Box 973, Pelham NH 03076. (603) 437-2722. (Toroids and 365 pF variable capacitor.)

Construction

This instrument should be constructed in a metal cabinet or box such as the Radio Shack 276-238, which measures 5½" x 3" x 2⅛". Tuning capacitor C1 is a standard broadcast radio capacitor with a maximum capacity of approximately 365 pF. If you don't have one in your junk box, they are available from Fair Radio Sales (P.O. Box 1105, Lima OH 45802) and other mail order dealers. Plate spacing is not a problem because of the high current/low voltage characteristics of a series circuit. Toroids for LI, L2 and T1 are available from Amidon Associates (12033 Otsego St., North Hollywood CA 91607) and other mail order dealers. Meter M1 can be any of the small surplus tuning meters with a full scale reading of 100 or 200 µA.

Most of the parts for this invaluable addition to your operating position can be found in your junk box with a little help from flea markets or other hams. I had to buy the aluminum box from Radio Shack ($2.49), but all the rest of the parts came from my junk box. Even if you have to buy all new (surplus) parts, the total cost should not exceed $10. This is a cheap price to pay for knowing your station is properly grounded for RF as well as DC, and your antenna installation is operating at peak efficiency.

Operation

Connect the shortest possible length of braid (preferred) or wire from J1 to the ground post on your transmitter/transceiver chassis. This chassis must, of course, also be connected to your station DC ground. Then attach a wire 10 or 12 feet long to J2, leaving the far end open. Be sure to tape up the open end of this wire so no one, including children or pets, can touch the bare end while your station is on the air. There will be a high RF voltage present at this end of the wire when transmitting. Dress this wire on the floor along the wall behind your operating position, or under the carpet if you have a fancy shack.

Tune up your rig on any chosen band. Then, with a constant carrier output—5 to 20 watts output will be sufficient—tune C1 (CAP) and SI (IND) for a peak indication on meter M1. There may be more than one position of S1 which works. Choose the position that provides the highest peak meter indication. Use the sensitivity potentiometer R1 to keep the needle on the meter scale.

Each amateur radio installation is unique. No two are exactly alike. At my station, position 8 of S1 is used to tune 30 and 40 meters. The higher bands use various taps selected by SI, providing less inductance. If you find that you have a meter indication on 10 meters, but it will not peak at minimum positions of SI and CI, shorten the wire connected to J2. If the same thing occurs on 40 meters at position 8 and maximum position of C1, lengthen the wire connected to J2. If you wish to operate 80/75 meters, either add a much longer wire to J2, or ignore the problem. This instrument is designed to provide an excellent, low impedance RF ground on those frequency bands where such a ground is most important—40 through 10 meters. Most ham stations operating on 80/75 meters already have a good RF ground because of the long wavelength and the relatively short DC ground lead to earth.

When you achieve a peak indication on the meter, the cabinet of the Artificial RF Ground is at ground potential for RF. If the length of braid or wire between J1 and your transmitter chassis is short, it too is at RF ground potential. Thus, you will have an excellent RF ground.

On some frequencies you may find that you can get a very low indication, or nothing, on the meter. If this occurs—congratulations! You already have an excellent RF ground on that frequency.

Caution

Although J1 and the chassis of the Artificial RF Ground are both at DC ground and connected directly to your transmitter chassis, it may sometimes be above ground for RF, especially while tuning for a peak on the meter. Touching the metal cabinet of this instrument may cause errors in meter indications. There is no danger involved but, by touching the metal cabinet, you are effectively placing your body in parallel with the series circuit, detuning it, and preventing a proper indication of resonance on the meter.

It's Worth the Work

Use of the Artificial RF Ground does more than please your rig. It will also eliminate any television interference that is not a result of harmonics or stray rectification. This will also please XYLs and close neighbors, a matter of importance to many hams, especially those in apartments or condominiums. Before I designed and installed this instrument, and operating at 10 watts PEP, my signals eliminated video and distorted the audio on several television sets in the house, as well as in a few surrounding houses, even though my rigs are clean and all the connections are solid in the antenna system. When installed and tuned to resonance, the Artificial RF Ground totally eliminated all TVI (we are served by a Cable system here), even on a 12-year-old color set sitting in the shack beside the rigs. Although fundamental overload may still be a problem for high power ham installations, using the Artificial RF Ground should eliminate all other sources of TVI, especially in Cable TV installations. 73

You may contact J. Frank Brumbaugh KB4ZGC at 82 Liddell St., Buffalo NY 14212-1824.

The ESV Mod Quad

Inexpensive performer for any band from 50 through 1296 MHz.

by Martin Beck WB0ESV

Because the idea of once again working DX on 6 meters appealed to me, I began searching for a method of building a really good antenna system. I prefer the quad, but in the past that ended up being expensive. This time, I decided I'd see what I could do using my favorite material: Acrylite™, a tough, clear plastic formulated for use with a chemical known as I.P.S. Weld-on #4.

The Mod Quad has some particularly desirable features. There is absolutely no metal employed in the spider assembly to skew the pattern. Even the boom is nonmetallic. The only tools you need to construct this quad are a measuring tape, a drill, and a saw. Once the materials are assembled, each quad element can be put together in one hour. No special skills are required, making this antenna an easy project for anyone. It's the least expensive antenna to build that I have seen to date.

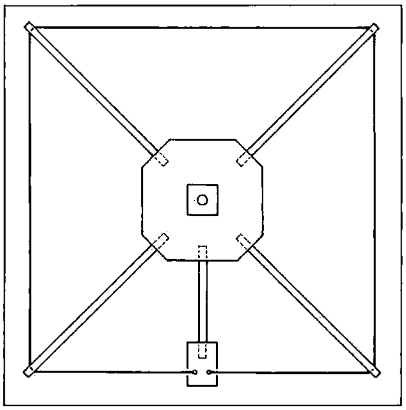

Figure 1. The ESV Mod Quad driven element.

Plastic Welding

In the plastic industry, the term "welding" means something entirely different from what it means in regard to working with metals. To illustrate: Let's say we place two clean, dry pieces of Acrylite together, and apply a couple of drops of Weld-on #4 at the edges of the junction. What happens? The chemical literally flows into the joint through capillary action. Once inside, it dissolves both surfaces, and the surfaces merge, becoming one. This is not a glued joint; the two pieces of Acrylite are now as much a single piece as if they had been originally cast that way.

Allowed to set overnight, the joint has twice the strength of one of the original two pieces.

The Spider Support

Make the spider supports by cutting out 10" by 10" squares of ½ inch thick Acrylite sheet (see Figure 2 and Table 1). If the ½ inch material is too expensive or unavailable in your area, just glue two squares of ¼ inch sheet together. For 6m and 2m, I like to glue enough squares together to make a 1 inch thick support (you can get away with ½ inch thick material as long as you beef up the corners to 1 inch, as shown in Figure 2). For 220 MHz and above, the ½ inch thick plate will work just fine, although it's best to trim it down to a 3" by 3" square (again, the corners need to be padded up to 1 inch, as in Figure 2).

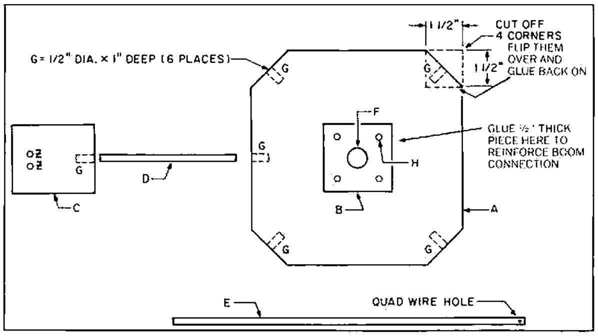

Figure 2. Details of the spider support arm. See Table 1.

Drill ½ inch holes into the edge of the support plate at the places marked 'G' on Figure 2. Insert a spreader arm (½ inch O.D. tubing or rod) into these holes and weld it (see Figure 1). Repeat this three times, and you have the ultimate quad spider—no metal, no mess. And it only takes a few minutes. Piece 'B' is used to beef up the main support plate 'A' where the boom joint is made. It's optional for 220 MHz and above. First drill four 1/16" holes in piece B (don't drill through the 'A' plate) to facilitate getting the welding chemical through to the 'A-B' surfaces. Glue piece 'B' onto the main square (6m and 2m quads). After everything is dry, drill a 1" hole in the center of the assembly to mount onto the boom (½ inch boom material can be used for 420 MHz and higher). Note that the arm labelled 'D' and the plate labelled 'C' are used on the driven element to support the coax attachment point.

The spider's center plate is joined to the 1" diameter Acrylite rod (the boom) by the same welding technique as above (see Figure 4). The boom should be carefully marked (I use a piece of masking tape) for element positioning and spacing, because once you've welded it—that's it!

Figures 1 and 5 include feedpoint construction, but of course, that is not needed for the reflector and directors. Also, you can have more than four elements by merely joining more 1" Acrylite joints, as shown in Figure 3, for a longer boom. The 0.2λ spacing can

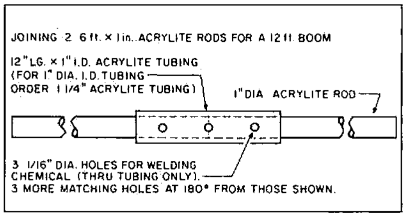

Figure 3. A small (glass only) syringe is handy for inserting the chemical into 1/16" holes. If you use a glass eyedropper, don't get the chemical in the bulb—it's plastic-based! Two to four drops per hole is ample. Allow 20 minutes set-time, then turn the assembly over and put the chemical in the three holes on the opposite side. Again, wait 20 minutes before disturbing the joint. Let it set overnight.

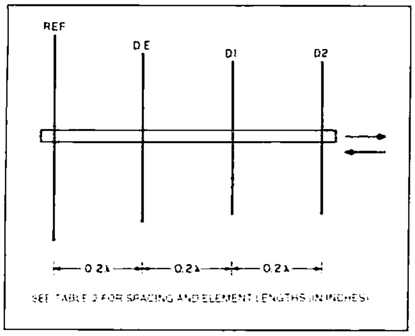

Figure 4. See Table 2 for spacing and element lengths in inches.

Table 1. The ESV Mod Quad Dimensions for 6m
Refer to Figure 2.

A	10" x 10" x 1" Acrylite sheet
B	4" x 4" x 1" Acrylite sheet. Drill four 1/16" holes for entry of Weld-on #4.
C	4" x 4" x 1" Acrylite sheet. Drill two holes for 6-32 bolts for feedpoint.
D	½" dia. x 22"L Acrylite rod or tube
E	½" dia. x 40"L Acrylite rod or tube. Cut four for spider arms.
F	1" hole through A and B for 1" Acrylite rod boom.

Note: Weld A and B together before drilling 1" boom hole.

G	1" deep x ½" dia. holes
H	1/16" holes
Z	Holes for feedpoint.

Note: The quad loop wire attachment hole on the spreader arm 'E' can be calculated from the following formula:

E (inches) = $\sqrt{(\text{Element Length}/4)^2/2}$. *(See Table 2 for Element Lengths).*

This distance is measured from the center of the boom. Make the length of your spreader arms an inch or so longer than this measurement.

also be used with a small two or three element antenna.

What do you do if by some weird circumstance you have a broken spider arm? Simple: Cut it off at the plate edge, redrill the hole, and weld in a new one! If you were to get two elements welded onto the boom with incorrect spacing, you could simply saw the boom in half between the elements, slip the sawed ends into a piece of 1" I.D. Acrylite tube, adjust the spacing—and, yes—weld the new joints in place. You can also use this method to increase the boom length beyond 6 feet (see Figure 3).

Acrylite is not expensive. Even with that latter term being relative, I feel the money is well within most hams' pocketbooks. And it's a strong material. Last year, a 116 mph wind storm broke all of my metal antennas, but not the Mod Quad. A friend reminded me of the Oriental tale of the resilient bamboo shoot that bent in the storm and sprang back, while the mighty but rigid oak was snapped. When buffeted by the wind, the Mod Quad does display a small amount of springiness.

Performance

The Mod Quad's gain is around 10 dBd. Properly spaced, a box of four quads makes a very potent system with a clean pattern. Since this quad is lightweight, it could be an outstanding antenna for Field Day. A simple TV rotor handles it easily.

While the spacing of 0.2λ gives excellent performance, you can play around with other spacings and possibly squeeze out a bit more gain. However, if you use the 0.2λ spacing, I have done all the element length and spacing for you. Refer to Table 2. The SWR is below 1.2:1 across 1 MHz, so this table is merely for the perfectionist. Most of the popular frequencies are listed. Many deadly serious DXers use 6 meters as their liaison band, but to avoid QRM, they stay higher up in the band. I computed the elements' sizes for that area as well.

Table 2. ESV Mod Quad and Delta Beam Element Lengths and Spacings

MHz	Sp."	Ref."	D.E."	D1", D2"
50.1	47.00	246.70	240.70	233.50
51.0	46.30	242.30	236.40	229.40
53.5	44.00	231.00	225.40	218.70
144.2	16.38	85.71	83.63	81.13
144.5	16.34	85.54	83.46	80.97
146.0	16.18	84.66	82.60	80.14
147.0	16.07	84.08	82.04	79.59
221.5	10.66	55.80	54.45	52.82
223.0	10.59	55.43	54.08	52.47
432.1	5.47	28.60	27.91	27.08
440.0	5.37	28.09	27.41	26.59
449.0	5.26	27.53	26.86	26.06
903.2	2.62	13.68	13.35	12.95
910.0	2.60	13.58	13.25	12.86
915.0	2.58	13.51	13.18	12.79
925.0	2.55	13.36	13.04	12.65
1250.0	1.89	9.89	9.65	9.36
1296.0	1.82	9.54	9.31	9.03

Note 1: Element spacing (Sp") = 0.2λ
Note 2: Element Length Formulas:
Reflector Length (Ft.) = 1030/F (MHz)
Driven Element (Ft.) = 1005/F (MHz)
Directors (Ft.) = 975/F (MHz)

What You'll Need

With the figures and tables, construction should be a breeze. Acrylite can be obtained from your local plastics store. Call Cyro Industries at (800) 223-2976 for a distributor near you. You may be able to find enough scrap material at one of these stores to complete the whole quad. If you can't find a local outlet, you can mail order materials from Lustercraft Plastics, Inc., PO Box 17367, Wichita KS 67217. When you write, be specific about items and sizes, and be sure to enclose an SASE. The manager requests that all orders be accompanied by a money order or cashier's check.

You can buy a four-ounce can of the chemical for a little over $2. That's enough for four Mod Quads, since only a small amount is used per joint. Full instructions are printed on the can. You can apply it with a toothpick, glass syringe, eyedropper, or even a small artist's brush.

The only materials you need for the 6m Mod Quad are five 6-foot joints (standard length) of ½" diameter Acrylite tubing or rod, a 6 foot length of 1" diamater tubing or rod (6m and 2m) for the boom (a ½ inch diameter boom can be used for 220 MHz and above), and as many 10" x 10" x 1" (or ½") thick plates as desired.

This methodology is inexpensive, fast, and very easy to follow. It produces a lightweight antenna of superior design, strength, and gain. While the system shown here is geared to 6 meters, it is even better as we use it on 144, 220, and 432 MHz; for the higher you go, the lower the cost. ■

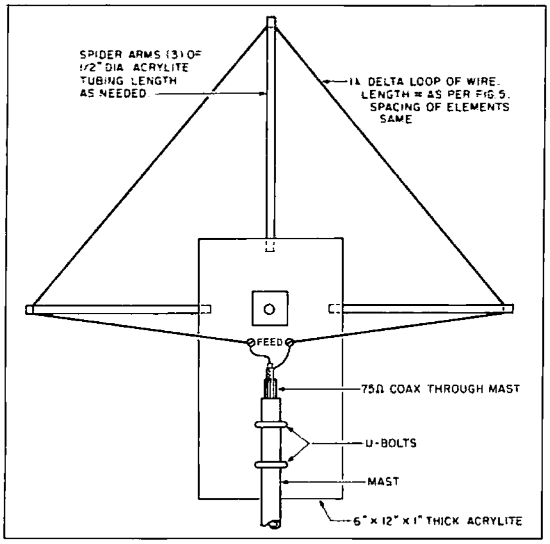

Figure 5. Modifications for delta loop beam.

You may reach Martin Beck WB0ESV at 1637 Hood, Wichita KS 67203.

73 Book Review

by David A. Clingerman W6OAL

Practical Antenna Handbook

Practical Antenna Handbook, by Joseph J. Carr
First Edition, 1989
Tab Books
Blue Ridge Summit PA 17294-0850
(Also available from Uncle Wayne's Bookshelf)
Price Class: $22

I don't usually get terribly excited over a book, but this is one that I couldn't put down.

It starts off with a very informative introduction that every ham will appreciate. The flow of the chapters is interesting, and logical. The book leads up to construction, rather than popping it on you first thing. This way the "old pro" can thumb to what he/she wants, and the beginner can work toward the meat and learn a lot along the way.

The chapters on propagation and transmission lines set the stage for later discussions. Mr. Carr received a lot of his material, as he states, from an old army training manual (TM 11-666). "Antennas and Propagation." I used the same manual when I designed a course on radio propagation, and I consider it a classic.

The "Transmission Lines" chapter contains many no-nonsense equations, and that's really all we need to understand and construct transmission lines. My college experience with transmission lines was most grueling because, for the text, the professor suggested a Schaum Series on the subject. The second page contained every partial differential equation known to man or woman. Carr doesn't do this to us. Nowhere in the book does he show us Maxwell's equations, may they rest in peace.

I enjoyed "The Smith Chart" chapter. Carr's approach is much like that of Sol Lapatine in his book, *Electronics in Communication*, Editions I and 2, which I use as a text in another of my courses. Without an understanding of the Smith chart, stubs and matching sections become very difficult.

The practical examples and good exercises presented are akin to a self-pacing text, which I like. Carr stresses safety quite a bit throughout the book and I feel that this is good, especially now as we are learning more and more about the biological effect of radiation on the human body. His mention of ways of keeping RF out of the shack, and of where those high voltage nodes are, should be heeded by everyone.

Carr doesn't forget that some of us are townhouse and apartment dwellers, and some of us have to live with covenants. He has something for us so we can be on the air, maybe not with a 4-element all-band quad, but with something with which we can get out.

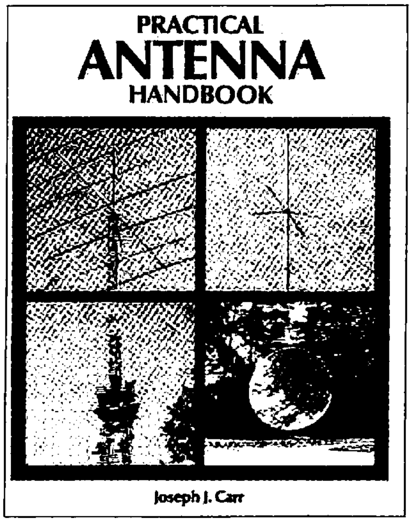

Photo. Practical Antenna Handbook.

His chapters on VHF/UHF covered the material adequately. I felt that there were a few holes, but the main points were covered. I also felt that the scanner and log periodic arrays could have had a bit more elaboration. The "Marine Radio Antennas" chapter was very good, including much attention to detail and excellent definition.

The only place where I thought more pictorials could have been helpful was the section on waveguides. I think it's easier to see TM and TE modes than to describe them. The microwave chapter fell down a little in that some substance was lacking concerning horns, loop yagis, and dipole/reflector feeds. I also feel that the section on mobile antennas could've been more extensive. Carr makes up for this with his section on matching. There were some very good hints on emergency antennas, and the measurements section had something for everyone. The construction techniques were adequate but short; the grounding section was very good. The appendices ("DXing the Smart Way," "Decibels," "Sources of Supply," and "Computer Programs for Antenna Design") were very informative, and there was plenty for the hackers.

Overall, I was impressed, and I highly recommend this book as either a reference or a text. As an engineering instructor, I plan to use this text for my course, "Practical Antenna Engineering." 73

David Clingerman W6OAL is currently employed by the U.S. Dept. of Commerce, NTIA, National Institute of Telecommunication Sciences in Boulder, Colorado.

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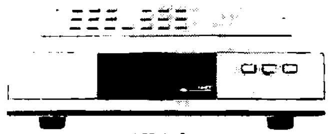

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73 Review *by Jim Gray W1XU*

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The AntennasWest HalfSquare is a simple, light, unobtrusive and inexpensive gain antenna that you can erect almost anywhere you can put a dipole. This useful antenna is rugged, neat, and plain terrific!

What kind of an antenna is a half-square? Read on.

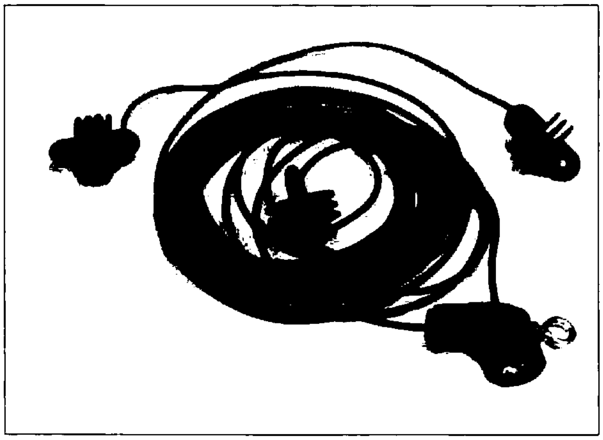

Photo. The happy HalfSquare.

Antenna Evolution

Nearly everyone has heard of the quad antenna, or the cubical quad array. The plain quad consists of a full wavelength of wire laid out in a rectangle, usually a square. A single quad loop has 1 to 2 dB of gain over a dipole, making it worth obtaining. A cubical quad array is merely two quad loops in a "space cube" figure. The array produces even more gain, something on the order of 5 to 6 dB over a half-wave dipole.

Now for the HalfSquare

The half-square antenna is just a single quad loop, opened up and stretched out to give greater gain and a lower radiation angle (see Figure 1). In the half-square configuration, that simple wavelength of wire is good for about 4 dB of gain. How does it happen? Simple. The source of the quad's gain is the separation between portions of the antenna having in-phase currents. By opening the loop and increasing the separation between the in-phase segments to a half wavelength, we more than double the gain of the quad loop. That's the secret of the half-square.

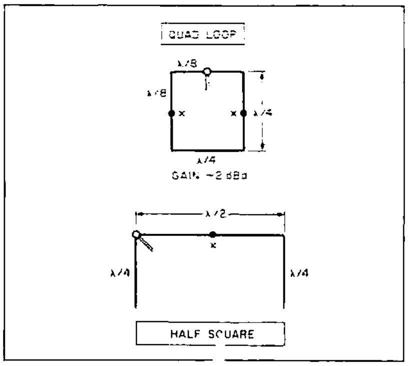

Figure 1. Cutting the quad loop and opening it out produces the HalfSquare. The half-wave spacing more than doubles the gain over the quad loop and the higher feedpoint gives a lower angle of radiation.

There's another advantage to the half-square method of using a wavelength of wire. Typically, a full-wave loop has a feedpoint impedance in excess of 100 ohms. That requires some sort of matching system. But if the half-square is fed at the right point, it has a perfect match to common 50 ohm coaxial cable.

Corner Feed

Let's return to the quad loop as a comparison. Since it is a complete loop, it will have the same impedance no matter where you feed it. But once you cut the loop and stretch it out, creating a half-square, the impedance seen by a feedline will depend on where you attach it to the wire. If you place the feedpoint at one end of the wire, the impedance will be on the order of a thousand ohms. But if you feed the half-square at a quarter wave from the end, at either of the corners, you will see an impedance of about 50 ohms—a nice match to coax without any tuner or matching transformers.

Corner feed has practical advantages, too. You can support your feedline with the antenna support itself, so you can bring the antenna closer to the house or shack. You can also use lighter supports.

To understand why corner feed works this way, think of the half-square as a pair of half-wave dipoles. Old-time antenna manuals used to feature the "quarter-up quarter-over" dipole. This consisted of a dipole with one vertical and one horizontal leg. Imagine two of these end-to-end and fed in phase.

The horizontal legs would have the same potential at their ends, so they might as well be joined. If joined, there is no need for two feedpoints; one is sufficient. The resulting antenna is the half-square. The radiation from the horizontal legs is self-canceling, but the radiation from the vertical legs is additive. The result is 4 dB of gain from an antenna that's the same length as a simple dipole (see Figure 2).

More important than the gain is the lower angle of radiation from the half-square. In fact, at the low angles that favor DX, the half-square has given me up to two S-units of signal improvement over a dipole at the same height. The drooping ends, the half-wave spacing, and the corner-feed system are the secrets of the half-square's great performance and good impedance matching.

Clever Construction

The AntennasWest HalfSquare is a delight to work with. The wire used in its construction is heavy-duty, black QuietFlex™ that resists kinking. In fact, I even tied it in a knot to test it. After untying it, I could find no visible damage or deformation. The wire's tough plastic covering makes it totally impervious to the environment. That means no noise from rain and snow, wind, or wind-born dust like we experience in Arizona. Under the insulation, the wire surface stays shiny-bright.

At the corner feedpoint there is a specially-

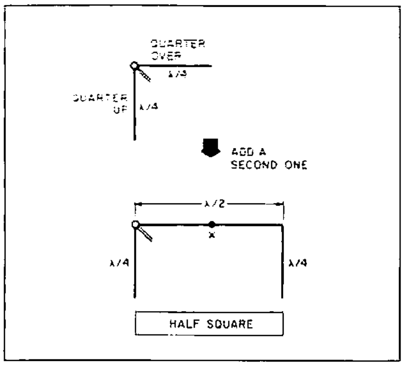

Figure 2. Evolution of the HalfSquare from a phased dipole pair. Connecting two quarter-up/quarter-over dipoles eliminates need for second feedpoint. Gain over a single dipole is on the order of 4 dB.

made housing that accepts the coaxial connector from your feedline. The connection is surrounded by a unique drip shield that keeps weather away from the mating surfaces. The housing also has a strain relief attachment point for the support rope that you use to attach the corner to the house, tree, mast, or whatever support you choose.

The two free ends of the antenna have a novel insulator that serves two purposes: The one we all know about—insulation—and the other, making tuning adjustments. A slip-and-lock arrangement permits easy adjustments of the length of the wire, which simplifies fine tuning for resonance.

AntennasWest makes HalfSquare antennas for each of the amateur bands, as well as for other bands where commercial, military, or industrial frequencies are used. Since an antenna that transmits well also receives well, it's no surprise that many HalfSquares are used for monitoring broadcasts from sensitive spots around the globe.

HalfSquares can be coiled, slipped into plastic bags with resealable tops, and carried in a suitcase. A HalfSquare needs no tuner to properly match the input/output impedance of even the most sensitive solid-state transceiver. The HalfSquare is an ideal portable DXpedition antenna.

If it's your pleasure to operate on more than one band (as most of us do), don't expect the HalfSquare to act like a beam on other than the band it was cut for. But don't be surprised to find that your antenna tuner will load it easily as a random wire on many other bands. As a random wire, my 20 meter HalfSquare has given service on 75, 40, 30, 17, 15, and 12 meters.

You might want to buy a HalfSquare for each band you operate on. Or you might get a HalfSquare for the band where DX competition is the greatest, or where you have DX goals, then use a general coverage antenna, like the G5RV, for rag-chewing. Many hams that run traffic to the South Pole or maintain schedules over long paths have found the half-square more consistent in performance than beam antennas because of its lower angle of radiation.

The price of AntennasWest HalfSquares built for the 10 and 12 meter bands is $40; for the 15 and 17 meter bands, $45; for the 20 meter band, $50; for the 30 meter band, $60; and for the 40 meter band, $70. Allow $5 for shipping and handling.

Conclusions

I am very happy with my AntennasWest HalfSquare. It's got a lot going for it with neatness, "invisibility" (it doesn't attract attention from the neighbors), a rugged and weatherproof design, usable DX gain, simplicity, and instant-easy use with any transmitter. I highly recommend them! 73

Jim Gray W1XU, 210 Chateau Circle, Payson, Arizona 85541, has been 73's Propagation columnist since 1984. He's been a ham for 39 years, and likes to operate CW on WARC bands 12, 17, and 30. He's also interested in aviation and photography.

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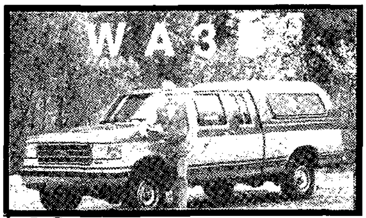

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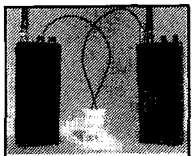
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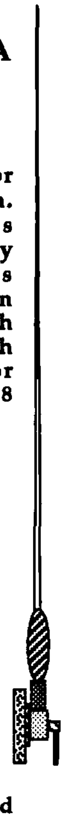
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Collinear for Two Meters

An inexpensive, efficient antenna.

by F.W. Lee G3YCC

In these days of black boxes, including all-singing, all-dancing multimode transceivers, the construction of antennas is one of the few worthwhile, practical options left for the radio amateur interested in 2 meters.

Two meter collinears remain one of the most popular choices for base stations, and there are many commercial designs available. However, I intend to show that for a minimal outlay and a few pleasant minutes of work, using readily to hand components, you can make an efficient antenna.

This antenna consists of two half-waves in phase with a quarter-wave matching section, or stub, allowing a good match to coaxial cable of 50 to 75 ohms (see Figure 1).

Construction

The raw materials you need are minimal and inexpensive, even if you have to buy them. But, we hope, you can find most of what you need around the garage or junk box.

First, you'll need two 39 inch long pieces of aluminum tube ½" (12.5mm) in diameter. You could salvage a TV antenna to obtain this.

Next, you need at least a 25" piece of 1¼" (29mm) PVC plumber's tubing and a length of #16 copper wire. You could cull these items from an old power transformer or, as in my case, from a length of hard-drawn copper wire left over from an HF antenna project.

The only item you'll most likely have to buy is the moulded dipole centerpiece, which is readily available at hamfests and ham shops.

Strengthen the PVC tubing by inserting a bung of wood or some other material in both ends for about 3" (75mm). It's particularly important to make rigid the end you're going to clamp to the support.

Cut a 40¼" length of #16 wire to make the quarter-wave matching stub. Solder a lug on one end of the wire and secure it under the nut or wingnut of the top element. Pull the wire 19½" (495mm) away from the attachment point while passing it along the top of the PVC tube. Then drill a small hole through the tube at this point and push the wire through. Bring the wire back along the bottom of the tube to the centerpiece, solder another tag to the end, and secure it to the bottom element. It's advisable to tape the wire to the tube as you go, to help keep the wire straight.

The dipole centerpiece supports the half-wave sections and the PVC tube by using fixing bolts. You might also use some sort of clamp to fasten the finished antenna to the mast or support. These are cheap. Brass or other metal studding can be pressed into service, too. Construction details are shown in the Figure and Photo.

Adjustments

No actual tuning is required, but you have to use the shack rig and an SWR meter to figure out the tapping points for the coaxial cable. Do this with the antenna in the clear, preferably with the full length of coaxial cable temporarily connected. Although the antenna is fairly broadband in operation, I'd recommend you adjust it with the shack transceiver set at a mid-band point.

Make adjustments with minimum power, and take care to switch the power OFF before you touch the antenna—RF hurts! A starting position of 12¼" (312mm) is given for the tapping points, but you must move both of these until minimal reflected power is shown on the SWR meter. The inner cable is tapped along the top wire, and the braid is tapped to a point opposite it on the lower wire. When you find the optimum points, solder these connections.

Now, waterproof the antenna. There are many products you can use, ranging from polyurethane varnish to bath sealant.

The antenna is ready for mounting in its permanent position on a mast or other support. You'll realize best results, of course, from an antenna mounted on a high point, such as a chimney lashing, mast or pole, using a minimum of coaxial cable.

This antenna should give years of good service for little expense, and it can be easily made in an afternoon. No specialized tools are needed. Even if all the material were bought, it's doubtful that the bill would exceed ten dollars, representing a considerable savings over any commercial vertical. The prototype cost me about half that, using materials to hand.

I'm sure you will enjoy the building experience, and you'll obtain a lot of satisfaction in having "done it yourself." 73

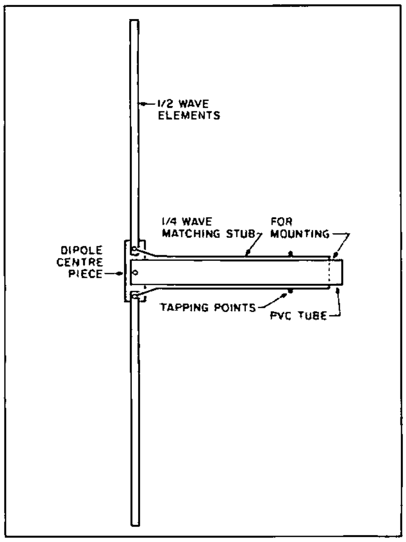

Figure. Construction details.

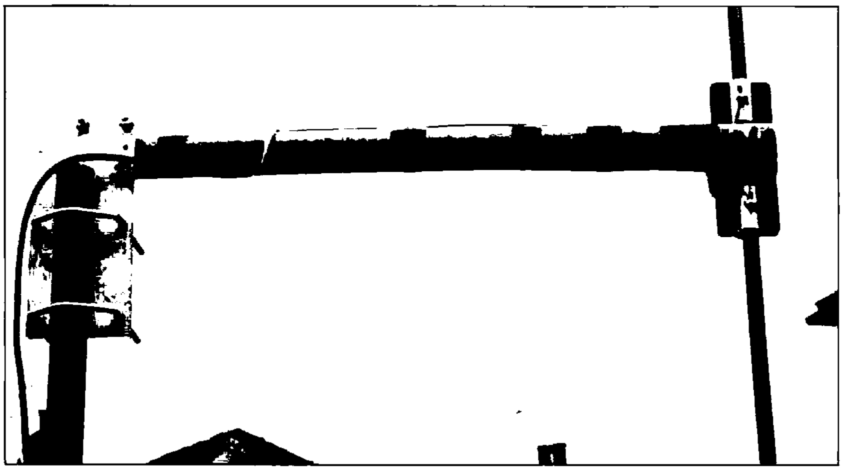
Photo. The completed collinear showing the mounting and feedpoint arrangement.

F.W. Lee may be reached at 8 Westland Road, Kirkella, Hull, England, HU10 7PJ.

Simple SupeRX

A super-small superhet for 80, 40, or 30m.

by Bruce O. Williams WA6IVC

A few years back, I developed the Simpleceiver (see the September 1986 issue of *QST*) using a ceramic 455 kHz filter. I decided to adapt that design to a receiver using more sophisticated components. The result is the Simple SupeRX described here. It uses just four 8-pin ICs, and receives CW and SSB equally well. With a reasonably well-stocked junk box, the total cost of the project is probably less than $40. How you package and tune your receiver has a big impact on cost, however. If you have to buy all of the components, plan on spending about $55.

The Design

There is nothing particularly exotic abou the design. (See Figures 1 and 2.) The NE602 is used as both a mixer and a product detector; U1 is the mixer, and the NE602 is used in a Hartley-oscillator configuration. I've found that using this type of oscillator is much simpler than the more common Colpitts type. Using a combination of subminiature monolithic capacitors, with silver-micas for the smaller values, results in an oscillator with almost no discernible drift. It is stable enough for extended SSB reception immediately after applying power.

The input voltage to both NE602s is regulated at +5V to add to the stability. U5 is a small, 100 mA voltage regulator. Since we only need about 3 or 4 mA for each NE602, there is very little stress on the regulator. The +5V is also the voltage source for gain control through the MC3340.

The Murata CFU455 series of ceramic filters is available from a few sources, although the cost of the device has increased considerably since I first started using it. There are several different versions of the CFU455, designated as A through J. The CFU455I has a −6 dB bandwidth of 2 kHz; the H version has a bandwidth of 3 kHz. Either version will work well in this application—for SSB, the H filter may be a little better.

Losses through the filter are made up by using an MC3340 variable attenuator (U2). This nomenclature is confusing, since the device is actually a variable-gain amplifier. The MC3340 is similar to some of the TV IF-amplifier chips, but it is much easier to use and offers two different ways of controlling gain through the stage. A 50k ohm variable resistor from pin 2 to ground will afford over 60 dB of attenuation. As an alternative, a positive voltage in the range of 0 to 5 volts applied to pin 2 will give the same result. This allows us to use the variable resistor for gain control, and to use a positive voltage from a transmitter keying circuit to reduce the gain through the receiver while using the receiver as a keying monitor. Although Figure 1 shows gain control through a 0 to 5 VDC source, either method can be used. The maximum gain through the MC3340 is about 16 dB—just enough to allow good headphone volume, or drive a small speaker.

Another NE602 at U3 acts as a product detector. The 455-kHz Hartley-oscillator configuration is extremely stable (on my old frequency counter, I measured less than 10 Hz drift from a cold start). The differential audio output of the product detector is routed through a Bessell filter centered at about 700 Hz, and applied to the two inputs of U4, an LM380N-8 audio amplifier chip. I found that the LM380N-8 chip, with a fixed gain of 34 dB, gives adequate audio output, but does not suffer from some of the internally generated hiss and noise that the LM386 sometimes

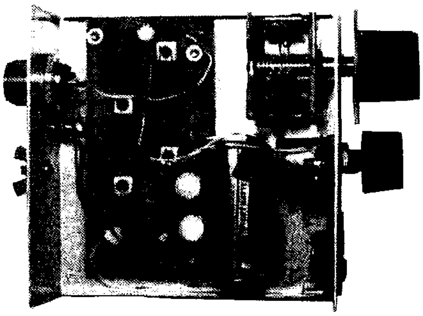

Photo A. The Simple SupeRX.

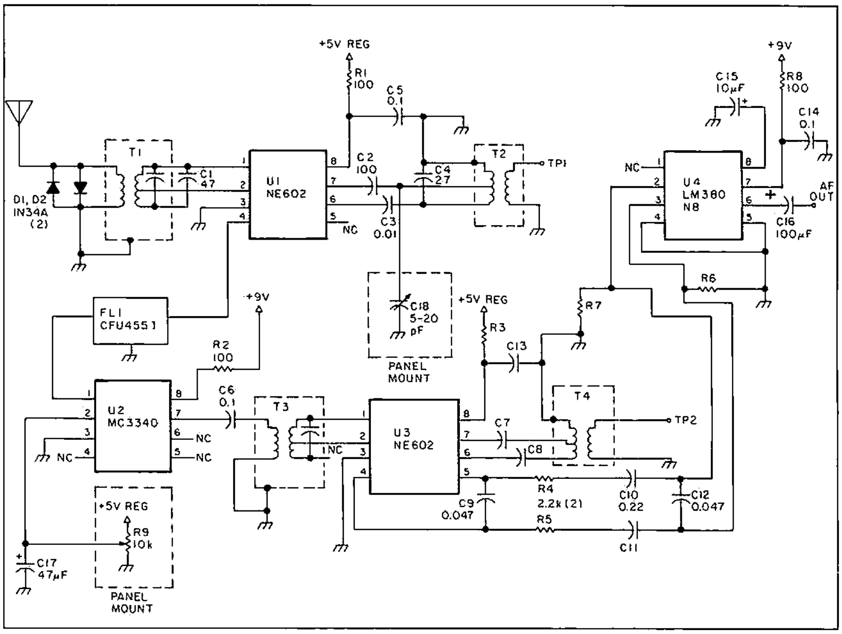

Figure 1. Schematic for the Simple SupeRX.

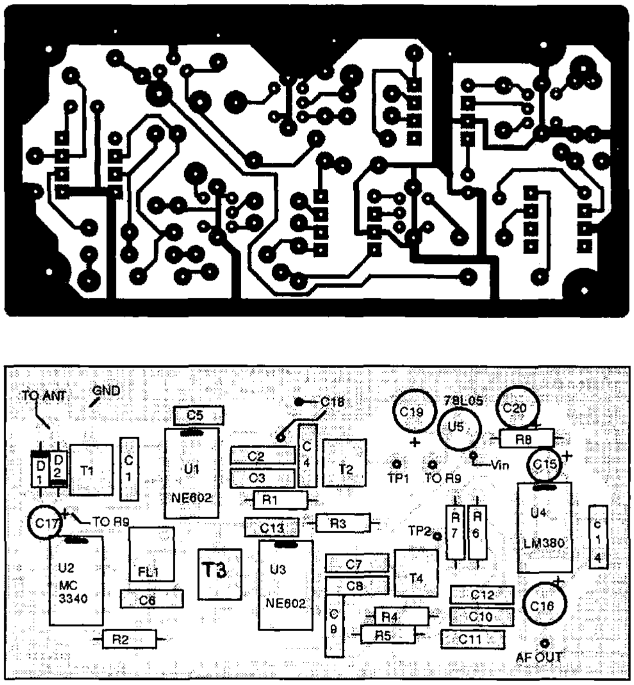

Figure 2. (a) Foil diagram, and (b) parts placement.

contributes. If you find that the LM380 doesn't have the gain you need, however, you can substitute an LM386 with just a slight change in the pin-out. The audio output can also be increased by using different values for the components in the audio filter. Changing R4 and R5 to about 1500 ohms will increase the audio output.

Construction

The table at right lists sources of parts. A printed-circuit board is available from FAR Circuits, and I am presently buying parts and assembling kits. Figure 2(a) shows the PCB layout, and Figure 2(b) shows component placement on the board. Even if you plan to build only one SupeRX, I recommend that you obtain the PC board, since it speeds construction. I've found that a receiver board can be completed in less than 2 hours.

For the prototypes, I used a product called "printed stripboard" that is available at very low cost from Dick Smith Electronics. PN H5614, the 3¾" x 3" printed stripboard, has a pattern of 0.1" wide strips that are drilled at 0.1" centers to allow mounting and soldering of parts to the board. The strips can be cut with an X-acto® knife or a special strip cutter marketed by Dick Smith to terminate the cir-

SupeRX Parts List

Part	Value	Type	
C1	47 pF	silver-mica or polystyrene	
C2	100 pF	silver-mica or polystyrene	
C3	0.01μF	polystyrene or monolithic	
C4	27 pF	silver-mica or polystyrene	
C5	0.1μF	ceramic disc or monolithic	
C6	0.1μF	polystyrene or monolithic	
C7	0.022μF	polystyrene or monolithic	
C8	0.1μF	polystyrene or monolithic	
C9	0.047μF	monolithic	
C10	0.22μF	monolithic	
	0.15μF*	(alternate)	
C11	0.22μF	monolithic	
	0.15μF*	(alternate)	
C12	0.047μF	monolithic	
C13, C14	0.1μF	ceramic disc or monolithic	
C15	10μF	electrolytic, 16V	
C16	100μF	electrolytic, 16V	
C17	47μF	electrolytic, 16V	
C18	5–20 pF	panel mounted tuning capacitor	
C19, C20	220μF	electrolytic, 16V	
D1, D2	1N34A	germanium diode or equivalent	
R1, R2, R3, R8	100 ohm, ¼W	carbon composition	
R4, R5	2.2k, ¼W	carbon composition.	
	1.5k	(alternate)	
R6, R7	10k, ¼W	carbon composition	
R9	10k	potentiometer	
T1, T2	10.7 MHz	microminiature (7mm) IF transformer, green core	Mouser PN 42IF223
T3, T4	455 kHz	microminiature (7mm) IF transformer, black core	Mouser PN 42IF203
U1, U3	NE602	double-balanced mixer	
U2	MC3340	variable attenuator	
U4	LM380N-8	audio amplifier	
U5	78L05	100 mA miniature +5V regulator	

* C10 and C11 can range from 0.1 to 0.22μf. Valves greater than 0.33 cause distortion.

Other: Printed stripboard, DSE PN H5614 or equivalent, cabinet, plastic stick-on feet, 4-40 hardware, etc.

Sources for Parts

Printed Stripboard
Dick Smith Electronics
PO Box 468
Greenwood IN 46142
(800) 872–1373

Transformers
Mouser Electronics
2401 Hwy 287 North
Mansfield TX 76063
(817) 483–4422
(800) 346–6873

NE602s and MC3340s
A&A Engineering
2521 W. La Palma, Unit K
Anaheim CA 92801
(714) 952–2114

LM380N-8
Digi-Key Corp.
701 Brooks Ave. South
PO Box 677
Thief River Falls MN 56701-0677
(800) 344–4539

Tuning Capacitors
Danny Stevig KA7QJY
PO Box 7970
Jackson WY 83001

KA7QJY has a fine line of reduction drives and capacitors; also a limited stock of NE602s and LM380N8s.

BCD Electro
PO Box 450207
Garland TX 75045-0207
(214) 343–1770

Note: You can get a drilled and plated PCB from FAR Circuits (N9ATW), 18N640 Field Ct., Dundee IL 60118. Price: $4.50 + 1.50 shipping each.

For a complete circuit board kit, you can also write to me at MXM Industries, Rt 1 Box 156-C, Smithville TX 78957. Tel. (512) 237-3906. Price for the kit, which includes the circuit board and all components is $49.95 plus $4.00 S&H. Texas residents add sales tax. Call for any hard-to-find parts.

cuit. This product is easy to use, and inexpensive, so you may not want to use a circuit board. The 40-meter prototype unit that I built used a piece of printed stripboard measuring 3⅝" x 2". I cut that board from PN H5112, a larger panel of stripboard.

If you opt for using printed stripboard, plan on spending several hours in construction. Before you start soldering IC sockets and transformers onto the printed stripboard, take time to plan the position of each major element. Use the general layout shown in Figure 2(b) for placement of the components. Taking time to plan in the beginning will be worth it later in saved time and materials. Always leave a spare hole on the strip, if you can—you may want to add some components later. Insert the various components into the board for planning, then sketch the layout. I start by locating the audio amplifier, then I work backwards through the circuit. I mount the components and solder them in the same sequence.

The choice of a cabinet is entirely up to you. Since there are only two controls, volume and tuning, a very simple package is possible. I obtained my tuning capacitor from BCD Electro. It is a small, inexpensive, single-gang unit with a built-in reduction drive. Its capacity range is about 5 to 20 pF, which gives a tuning range from 7.000 MHz to about 7.225 MHz to cover most of the 40 meter band. If you use a larger tuning capacitor, you should place a small capacitor in series with the tuning unit to reduce the range. You'll have to experiment a bit to get the right value. Of course, you could use a voltage-variable-capacitor tuning scheme with just another potentiometer on the panel, rather than a tuning capacitor.

The problem of a tuning indicator is easy to solve. You will find that for most purposes, you will be able to guess at your calibration. If you use a tuning capacitor with a built-in reduction drive, you can allow the inner 1:1 shaft to protrude a little through the front panel, and use a ¼" collet with a pointer soldered on it to indicate the received frequency with a calibrated dial pasted on the front panel. I use the ¼" insert from an old dial knob. Most old knobs have brass inserts, and you can remove the insert from the knob with a hacksaw. It is a simple matter to solder a brass indicator to the insert and install it inside the cabinet on the inner shaft. Allow just enough of the insert to protrude through the panel to give you a 1:1 tuning indicator.

Powering Up

The choice of power for the unit is easy! At high volume, the SupeRX draws about 30 mA. I use a 9 volt transistor radio battery mounted in the cabinet, with a subminiature open-circuit jack to allow hookup of an external battery or wall-transformer 9-to-12 volt supply. A 9 volt transistor battery will last for several hours, but for extended use, I recommend a larger 9-to-12 volt battery or other power source. Be forewarned that most of the cheaper wall-transformer units are designed for battery charging, and have only half-wave rectifiers with practically no filtering—they create so much hum or noise that they're unusable!

I hate winding toroids, and as a result, I've never really learned how to do it well. There are no toroids in the SupeRX! Instead, I use microminiature 10.7 MHz and 455 kHz transistor radio IF transformers. Be sure you get the smaller (7mm) "microminiature" units—their pins are just the right spacing for stripboard, and they fit the available PC board. You will have problems mounting the larger (10mm) "subminiature" transformers.

One of the "rules" for using the NE602 mixer is that input pins 1 and 2 must not be directly connected to ground. Any padding capacitors must be connected across the tuned portion of the input transformer, and the "retuned" portion isolated from ground as shown in Figure 1. If you build your unit for 30 meters, no additional padding capacitors across the transformer are required. If you are going to be on 40 or 80 meters, you will have to add capacitors across the tuned circuit in the transformer—about 47 pF for 40 meters, and about 240 pF, or more, for 80 meters. Remember to include the tuning capacitor capacitance in the calculation—that is, for 40 meters, the value of C4 should be about 27 pF since the tuning capacitor has about 20 pF, maximum.

Alignment

You need no special test equipment to align your SupeRX. There are only four adjustments, all of them to the transformers and requiring only a screwdriver. Remember to use an insulated screwdriver or tuning tool. I solder pieces of scrap component leads to the secondaries of the oscillator transformers, (marked TP1 and TP2 on the schematic), and use my frequency counter or oscilloscope for a rough calibration. If you don't have a scope or a counter, you can use your receiver for a rough calibration. Connect a short piece of hookup wire to the receiver antenna, and place the wire near to the oscillator you are checking. Remember that since we are using a 455 kHz IF, the local oscillator will be operating at 455 kHz above or below the received signal. Thus, to get a rough alignment at 7.000 MHz, you would tune your oscillator to either 6.545 or 7.455 MHz. Most ham band receivers have sufficient out-of-band range to allow you to tune the mixer oscillator.

Aligning the 455 kHz oscillator in the product detector can be done in the way described above. If you do not have a scope or counter, you can use an AM broadcast receiver. Almost all BC receivers have a 455 kHz IF. If you couple your product-detector oscillator to the BC receiver with a short piece of hookup wire loosely wound around or placed near the oscillator transformer and the BC radio IF transformers, you can tune the oscillator close to 455 kHz. Tune for a zero beat from the BC receiver. The final tuning of the BFO is accomplished with on-the-air signals.

All additional "fine tuning" is done with the SupeRX operating. The input transformer, T1, is peaked on an incoming signal, as is the 455 kHz coupling transformer, T3. The tuning of the product-detector oscillator should be done on an SSB signal—if you tune the BFO so that you can copy an LSB signal, the frequency of the oscillator is properly located near the edge of the IF passband, affording near single-signal reception—optimum for CW reception.

Conclusion

There you have it, a simple but adequate receiver for CW or SSB. I have found that although many designers bad-mouth the NE602 because of its limited dynamic range, it performs more than adequately for a simple CW receiver. It offers a lot of features that other devices don't: low cost, availability, and ease of use and alignment. I added a switchable 10 dB attenuator in the antenna input, which reduces some of the high-level signals we find on 40 meters down here in Texas. The *ARRL Handbook* gives values for different degrees of attenuation.

I have coupled my 40 meter SupeRX to a 2W crystal controlled transmitter. I use the 12 volt keyed voltage to attenuate the MC3340 gain to allow using the receiver as a keying monitor. It works OK, but I still haven't solved all of the audio thumping problems. At present, it's better to use a panel switch for changing from receive to transmit.

You can adapt any one of several excellent transmitter designs in the literature, I'm sure, to give you a small, easy-to-build QRP rig with excellent performance at minimum cost. A $1,000 rig to work CW is not at all necessary! 73

You may reach Bruce O. Williams WA6IVC at Rt. 1 Box 156-C, Smithville TX 78957.

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73 Review

by Bill Clarke WA4BLC

The Carolina Windom 160

The Radio Works
Box 6159
Portsmouth VA 23703
(804) 484–0140, FAX (804) 483–1873
Price Class: $95

Work 160–10 meters with just one antenna.

Recently, I decided to become active on 160 meters. It was either that or miss out on one of my evening nets for the remainder of the winter. Remembering that this project would be used for SSB rag-chewing and not heavy-duty DX, I went over the various antenna answers that are generally thought of for 160. I eliminated some of them as requiring too much work (ground radials, etc.) or as too limiting (monoband). Then, along came the Carolina Windom 160, from The Radio Works, another version of that marvel W8GZ gave us back in 1928.

In December 1988 I reviewed the Carolina Windom standard 80–10 version. I used it for many months at my Virginia QTH, then moved it to my new QTH. With a tuner, its versatility allowed me to operate on any of the bands, including WARC, from 80 through 10 meters.

This multiband versatility was what attracted me to the 160 version of the Windom. I could use it on top band and all the other bands, too. It could act as a backup to my trusty dipole on 75, and see primary use on 40 and up. Not bad for one wire.

A "Package of Antenna"

The package the 160 comes in will surprise you. It's a plastic bag, of some weight, containing the wire elements (265 feet of #14 multistrand copper wire), a 22-foot RG-8X vertical radiator, a line isolator, and a matching unit (used like a center insulator). Now, before you ask . . . if you want, you can order the 160 with #12 stranded copper or copper-weld wire. In locations prone to high winds, the latter may be a prudent choice, but my 160 has experienced winds in excess of 75 mph and suffered no failures.

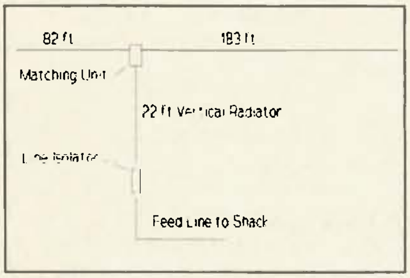

Figure 1. Diagram of the Carolina Windom 160.

Photo A. The Carolina Windom 160 package, unassembled.

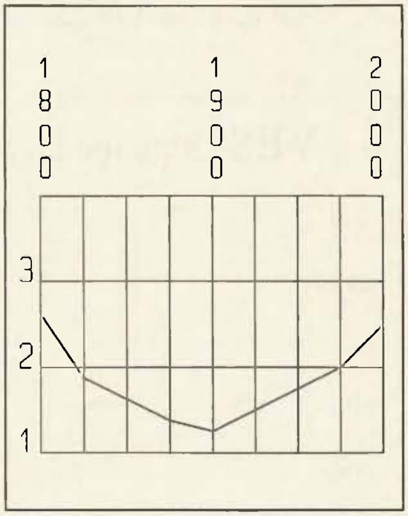

Figure 2. SWR plot of the Windom on 160 meters.

Installation

I installed the 160 in a drooping dipole manner: the highest point at 48', with the ends dropping down to about 20'. Keeping the ends

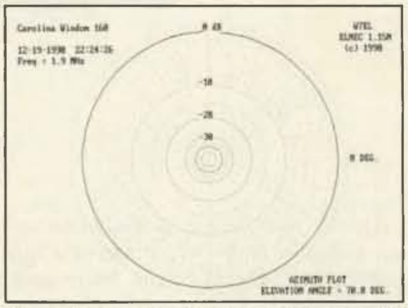

Figure 3. Azimuth plot of the Windom on 160 meters (using ELNEC 1.15M).

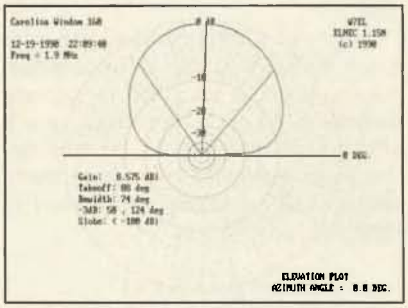

Figure 4. Elevation plot of the Windom on 160 meters.

in the air avoids possible contact with unauthorized creatures (deer, cows, neighbor's kids, etc.). The 160 is supported about 15 feet from the matching unit (center insulator) and vertical radiator. A movable insulator is placed on the long element just for this purpose. This is to eliminate the possibility of interaction between the tower and the radiator. The line isolator is about 18 feet in the air.

Tuning

The SWR curve is gentle and I am able to operate from 1.825 MHz to 1.975 MHz without needing a tuner. On the remaining bands (80–10), the use of a tuner is mandatory. However, all bands tuned easily and appear relatively broad.

How It Works

The Windom is fed off-center. In fact, this model is fed about 50' off-center. Therefore, because an unbalanced condition exists at the feed point (the RF current is out of bal-

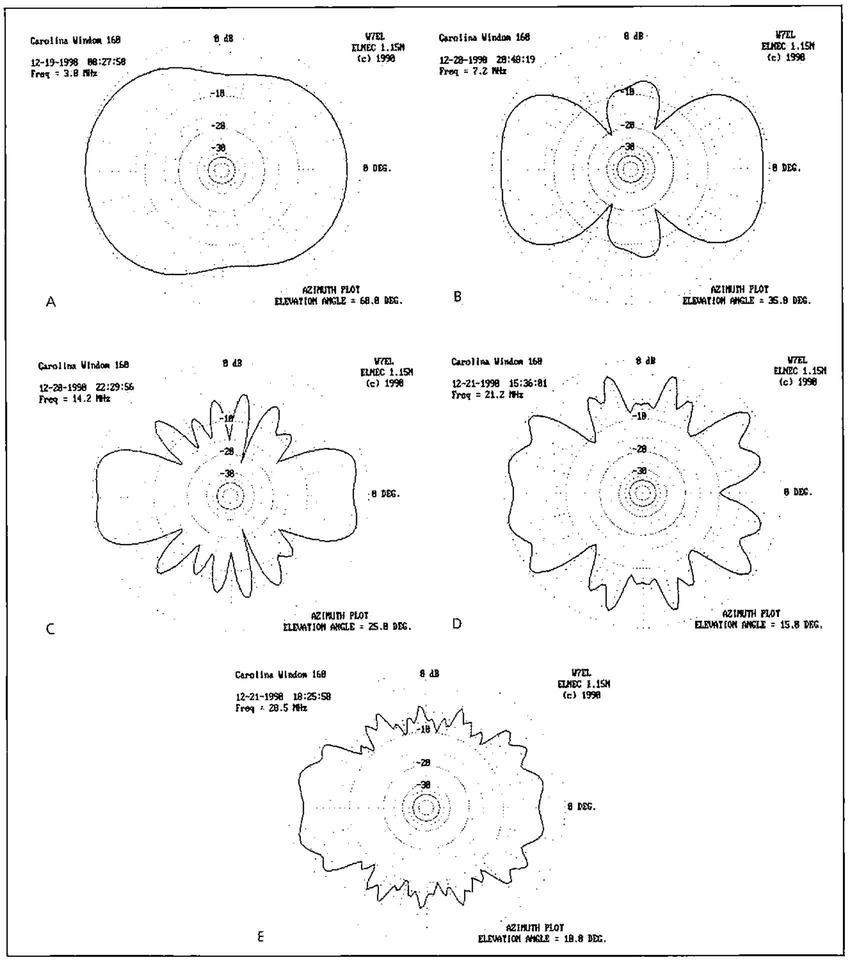

Figure 5. The Carolina Windom 160's azimuth pattern for 75m (a), 40m (b), 20m (c), 15m (d) and 10m (e). meters.

ance), the coaxial feedline will radiate. This is a planned condition and is the reason this type of Windom is so effective on the higher bands.

Naturally, you don't want to have uncontrolled radiation from the feedline. To limit it, a line isolator has been installed at the feed line end of the vertical radiator (22 feet down). From this point to the transmitter there will be no feedline radiation.

The vertical radiator, in the case of higher frequencies, gives the effect of an inverted vertical antenna. The horizontal elements continue to radiate as would be expected, giving a combination of horizontal and vertical radiation.

As with all multiband wire antennas, some gain and directivity will be attained as the frequency goes up.

On The Air

On 160 meters, I consistently work up and down the East Coast and am very pleased with the good reports I get. Of course, you must remember that with the antenna as low as it is (48'), DX will indeed be rare.

Specifications

Freq. Coverage	160–10 meters
Gain	As much as 10 dBd
Size	265' H x 22' V
Polarization	Vertical & horizontal
Feed Line	50Ω coax
Matching method	See text
Power rating	1500W recommended
Height	40' (usable at 35')

On 75 meters, for contacts under 1,500 miles, I have found that it is generally 5 to 10 dB down when compared to my 75 meter dipole at the same height. This is a general statement, as there have been exceptions to the rule. Beyond 1,500 miles, the Windom takes over, usually 5 or 10 dB ahead of the dipole.

On 40 meters, there is a slight edge with the Windom. Consistently, whether DX or local, the Windom wins over the inverted vee by about an S-unit.

On 30 meters and up, the Windom is all I have at the present time. There is no tribander or other fancy array to compare it with, but I'm very satisfied with the Windom's overall performance. I did, for a short time, compare the original Carolina Windom to the 160. Although there were a few times when one or the other seemed to be slightly ahead, there was generally no difference. End result: An improved antenna that didn't take away from the original version.

The Plots

The plots shown in Figures 3 through 7 were done with ELNEC (see my review in *73*, January 1991), and printed on a Canon Laser printer.

Nice Points

All the pre-made connections were good and solid. The vertical radiator, a piece of RG-8X coax, is pre-made with an end connector and the line isolator installed. There is a small movable insulator on the longest leg to facilitate hanging the antenna. Coax Seal comes with the antenna...use it, it'll save you grief later on down the road.

Problems

Of course, the 160 does have a few drawbacks. Specifically, its size of 265 feet. Having used wire antennas in many difficult and small installations, I can assure you that some bending of the end elements is quite acceptable. Signal degradation will be negligible, unless you actually fold the wires back on themselves. So don't be daunted by restrictive lot sizes.

Final Remarks

Would I recommend it? Yes, the Carolina Windom 160 is a really good all-around antenna that works well on the lower bands and exhibits gain and directivity on the upper bands. Due to the vertical radiator, it is a step ahead of the typical multiband wire antenna, as seen in the plots. The size is somewhat formidable, but the Carolina Windom 160 is a single antenna that does it all from local 160/75 round tables to 10 meter DX. 73

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73 Review

by Bill Clarke WA4BLC

Ameritron's AL-811 Linear Amplifier

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Ameritron
921 Louisville Road
Starkville MS 39759
Tel. (601) 323-9715
Price Class: $599

In the world of linear amplifiers, only one factor seems to be emphasized: cost. The higher the cost, the better the amplifier. And the better the amplifier, the better the signal. Hmm, the latter is an interesting premise, but not necessarily true.

The object of a linear amplifier is to increase the RF output of your station. In simple terms, to increase the talk power. When figuring power increases, you must be aware of a general understanding among radio operators—the law of decibels.

Let's take a typical 100 watt PEP exciter (the average modern transceiver output) and double the power. The new output of 200 watts is an example of 3 dB gain. This gain represents what is considered a noticeable received signal increase, attained every time the power is doubled. This, doubled to 400 watts, makes a total gain of 6 dB; 800 watts, a gain of 9 dB; 1600 watts, a gain of 12 dB. Of course, the FCC limits power out to 1500 watts, but we won't split hairs over the extra one hundred watts for this paper exercise.

You can see from the example that the greatest gains are at the lower watt end of the scale. What, you ask, does this have to do with a review of a linear amplifier? Simple economics! It is much less expensive to attain a 9 dB gain than a 12 dB gain. In fact, going from 100 watts to 800 watts will be less expensive than going from 800 to 1600 watts. The power supply can be smaller, the tube(s) cheaper, and the internal components need not be as heavy.

Today I feel it is safe to say that you will usually spend a minimum of a thousand dollars for an amplifier that produces a 9 dB gain, and twice that for the remaining 3 dB.

With the introduction of the AL-811 amplifier, it's refreshing to see a quality amplifier for under $600.

Installation

The AL-811 comes in a double box, well-designed to protect the amplifier shipped inside. This amplifier looks like an amplifier: The case is large and the controls are not the sub-mini size we are used to on our imported rigs. The two front panel meters are well-lighted and easily read. One meter displays either high voltage (HV) or plate current (Ip), the other monitors the grid current at all times. A red LED indicates key-down, and a standby switch is included on the front panel.

Inside the AL-811 you will find three 811As in a grounded grid arrangement. This is an old and well-proven tube design, originally developed for use in RF. They are capable of handling considerable abuse at the hands of hams lacking tuning expertise. In the event of failure they are readily available for about $25 each. This is considerably less than even the 3-500Z, which now goes for well over a hundred dollars.

To prepare the unit for operation, just remove the cover's screws and lift it off. Inside you will find plastic foam around the tubes and a bag containing the neatest fuse holders and fuses I've seen recently (they push in and pop out; they're not the old screw-in type). After removing these materials and checking the tubes and other components for security, I replaced the cover, installed the fuses, and hooked the amplifier up.

While inside the unit, I took note of the very nice glass epoxy circuit boards, excellent structural design, and quality of workmanship. All was top grade. Unlike many amplifiers I have examined over the years, the chassis of the AL-811 does not use the cover as an integral part of the chassis (stiffener). It is just a cover, and no more.

The RF input circuit is a very solidly built Pi-network tuned slug system. The Pi-network output circuit is of equal quality. The power transformer connections, using a buck boost winding, can be changed to accommodate 120/110/100/240/230/220 VAC, making it workable nearly anywhere.

An ALC circuit is built into the AL-811 to prevent excessive drive levels from damaging the amplifier, and to prevent the resulting RF interference it causes.

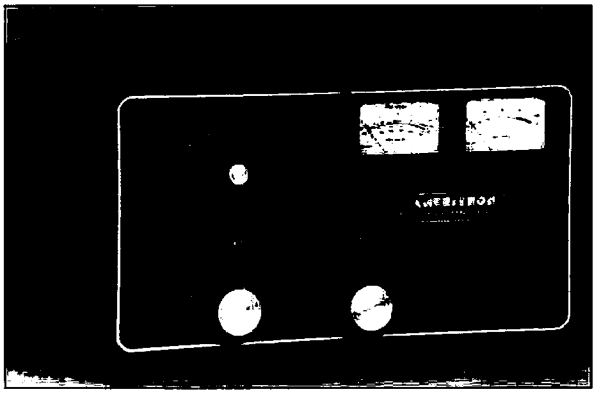

Photo A. The AL-811 covers the 160–15 meter bands.

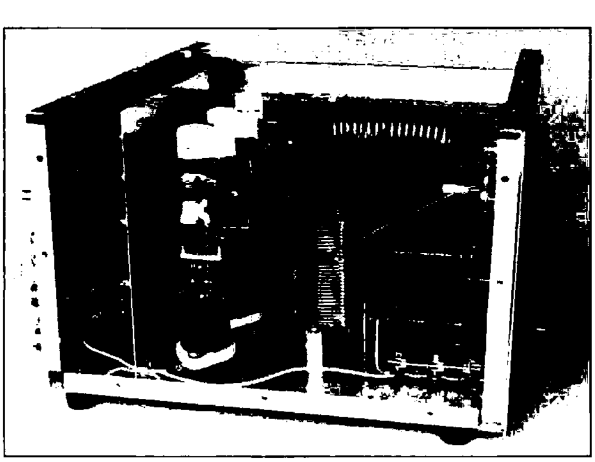

Photo B. An inside peek reveals the quality construction.

Observations

For the sake of safety, and for the edification of the many hams who have never operated anything using more than 12 VDC in the power supply, Ameritron has included internal and external labels warning of the lethal voltages present within the amplifier.

The instruction manual is short and to the point. I would advise anyone using the amplifier to read it before turning anything on. Included with the manual is a one-page generic set of instructions for tuning all linear amplifiers. This fine page should be read by all using, or contemplating using, an amplifier, as it answers many questions you might ask.

I noticed some contradictions in the manual involving input power. Depending on where you look, you might see a "never exceed" limit of

70, 85, or 100 watts. For the purposes of this evaluation I chose the latter, as that was the power mentioned in the tune-up section.

Ameritron's one-year product warranty does not appear to include the tubes. No mention of warranty on the tubes was seen.

Using the AL-811

The AL-811 comes from the factory set up for 120 VAC. As the current draw is not high (max. of 8 A), you may not need to do any extra wiring to use the amp. This will depend upon your house or shack wiring. I can tell you, however, that if you locate the amp over fifty feet away from your circuit breaker box on a #14 line, you will experience a significant voltage drop during key-down.

My recommendation for this, or any RF amplifier, is to operate it on a circuit of its own. Plug-in power bars, although nice for powering small equipment, are not satisfactory for powering an amplifier. (See the table.)

Watching the output signal on my scope, I saw no bad news. The signal never flat-topped. In getting signal reports, I switched between the AL-811 (700 watts) and my AL-80A (900 watts). In some cases I told the receiving station what I was testing, while in other cases I kept the station in the blind. There was never a time when the AL-80A was reported better than the AL-811. Reports were "no change seen," as expected.

Due to the law of decibels, as described earlier in this article, the difference of a couple of hundred watts won't be noticed at the receiving point. Of course, you could spend another thousand dollars and get a "full power" amplifier to get that last 3 dB.

The Judgment

What I liked the most about the AL-811 included the stout chassis, inexpensive tubes, quiet fan operation (my computer makes more noise), excellent internal construction, and the 12 VDC keying circuit.

My dislikes were few. It would be nice, for example, if the meters were slightly larger. Also, I found some mistakes in the manual.

Do I recommend this amplifier to other hams? Very much so! It is cost effective, something you rarely see in ham radio these days. 73

Output Chart
(100 Watts Input)

Band	Key-down Output (Watts)
160m	670
80/75m	700
40m	640
30m	650
20m	650
17m	630
15m	640
12/10m	not tested

AL-811 Specifications

Frequency coverage:	160–15 meter bands (12/10 meter modifiable)	
Input circuit:	Pi-network with slug-tuned coils	
Output circuit:	Pi-network	
Tubes:	Three 811As in a grounded grid configuration	
Maximum drive:	85 watts	
Typical drive for rated output:	55 watts	
Power output:	30 second carrier:	550 watts
	½ hour carrier:	400 watts
	30 second PEP two-tone:	600 watts +
	½ hour PEP two-tone:	600 watts +
Efficiency:	70% or better	
ALC:	Negative-going (adjustable from 0 to 20 V)	
Power supply maximum draw:	8 amps @ 120 VAC	
Dimensions:	16"(d) x 13"(w) x 8"(h)	
Weight:	30 pounds	

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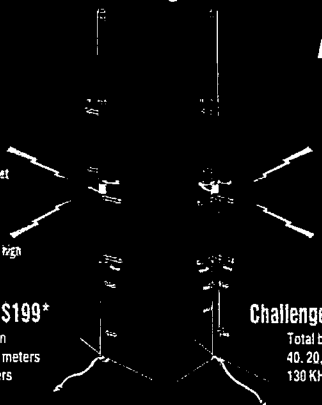

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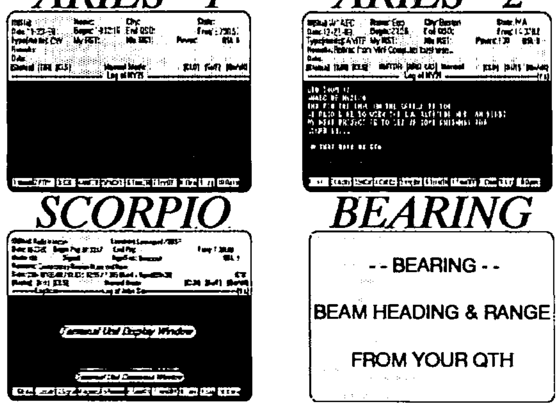

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73 Review

by Drayton Cooper N4LBJ

SV Products' WARC Band Yagi

Model 1824/2L—a super buy!

SV Products
4100 Fahlsing Road
Woodburn IN 46797
Tel. (219) 632-4642 evenings and weekends
Price Class: $200 plus UPS.

Adding a dedicated antenna for 17 and 12 meters is a sure way to improve your performance on these bands. Until recently, there were few beams commercially available for the WARC bands, and most operators used what they had on hand: an all-band Zepp, a G5RV, a dipole, or a random wire.

The Evolution of a Dipole

Today, several manufacturers offer yagi designs for 17 and 12 meters, and the amateur operators who use them are beginning to realize the vast difference they make. One of the first 17/12 meter beams was produced in kit form by Gary Nichols KD9SV, under the trade name of SV Products.

A well-known low-band DXer, Nichols moved to 17 meters early in the game, like many other 160 meter fans, and immediately began developing an antenna for the band. His first product was a trapped rotatable dipole, which was well-received by some of the pioneer WARC band stations.

I started out with this kit, then, when he started making the 2-element kit a little over a year ago, I bought the "add-on" reflector. Two months later, I got a note from Gary telling me he had discovered that some of the stainless fittings he had bought and shipped with the kits were corroding slightly in some applications, and he was voluntarily making them good. The next day, UPS brought me a box of all-new stainless hardware. It was a nice touch.

The 2-Element Yagi

The SV Products' 2-element yagi design features an exceptionally clean pattern, moderate gain, novel trap design, compact dimensions, and ease of assembly. It's made of high quality aluminum tubing with stainless steel hardware, and it's attractively priced at $199.95 plus UPS shipping charges.

The SV Products dual-band beam has several points which make it a good choice for the ham who wants to expand his capabilities on 12 and 17 meters. Among these is the "coaxial" trap design. The traps (two per element) are completely weatherproof, immune to fouling by bugs or dirt, and able to withstand the legal power limit with ease.

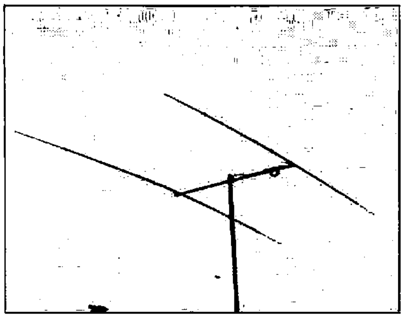


Photo. The SV Products' 1824/2L.

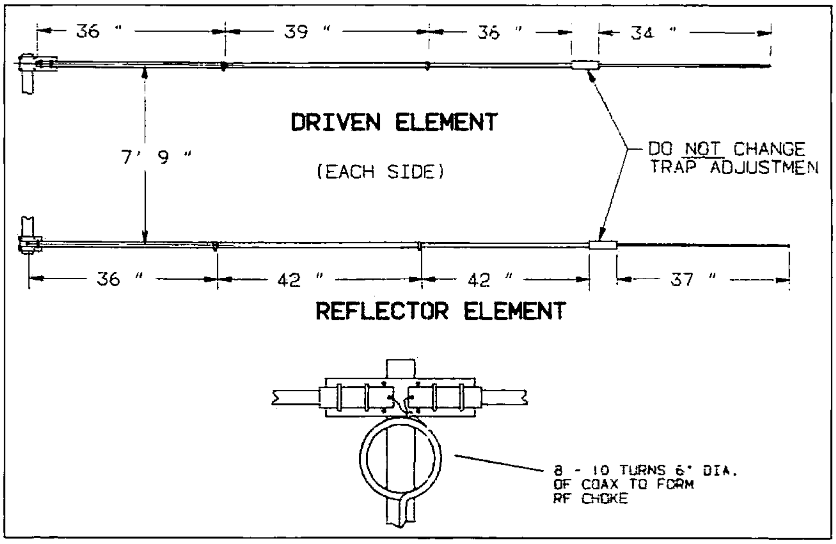


Figure 1. Element and feedpoint details.

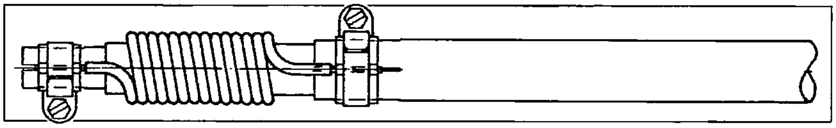


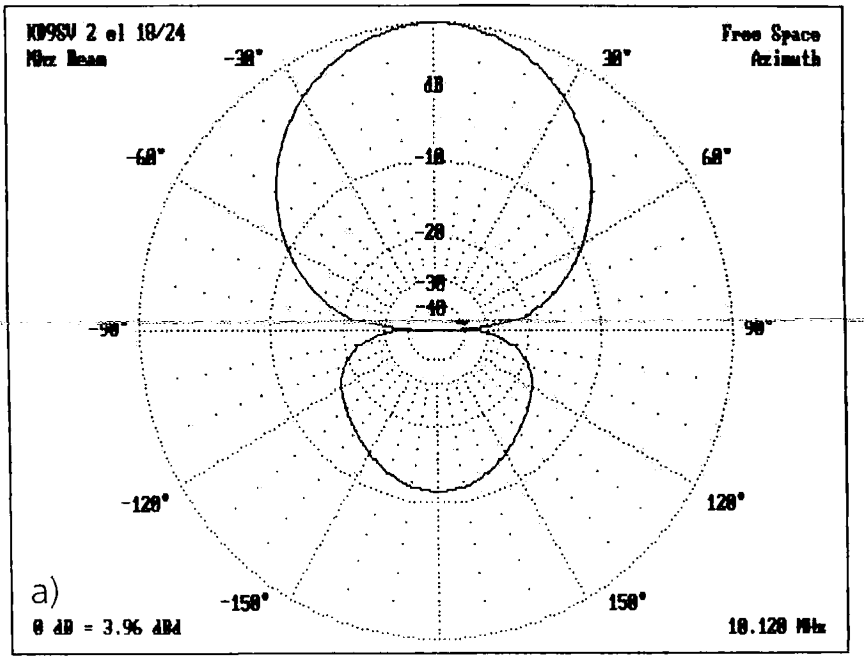
Figure 2. The coaxial trap.

Additionally, the traps should never need any adjustment, and, unless subjected to a direct lightning hit, they ought to last forever. A more complete discussion of the design of the traps can be found in the May 1990 issue of *Ham Radio*, in an article by Nichols.

KD9SV makes no gain claims for the antenna, but after a year's experience with the beam, I can assure you that its F/S ratio is excellent, and its F/B is at least as good as the computer-derived plots (see the figures). Also, the forward gain is certainly worthwhile.

The theoretical forward gain figures for this antenna, based on the computer study, are 3.96 dB for 17 meters and 3.99 dB for 12 meters. These values are certainly borne oul by my experience with the antenna, and while they do not approach the figures you'd expect from a 4-element, wide-spaced monobander, they are surely respectable for a beam of this size.

The SV Products beam is directly fed with 52 ohm coax. The driven element is split at the feedpoint and insulated from the boom, obviating the need for a matching device. This system simplifies assembly considerably. Nichols strongly recommends a coaxial RF choke at the feedpoint. This choke is easily constructed by looping the feedline into an 8-10 turn coil about 6 inches in diameter just below the feedpoint.



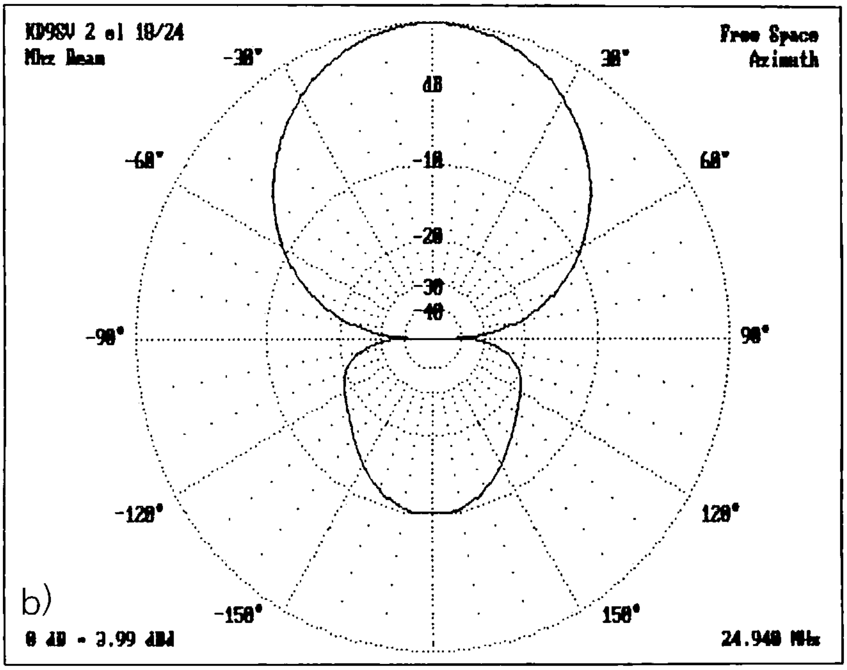


Figure 3(a). Computer plot of the azimuth pattern for 17m. (b) Azimuth plot for 12m.

Assembly, Testing, and Installation

I found construction of the antenna to be first-rate, and assembly a snap. A friend and I, working together, had the beam fully assembled and ready for testing in about an hour. The dimensional drawings provided in the package are superbly done and extremely simple to follow. No step-by-step assembly instructions come with the antenna; none are needed because of the simplicity of the design.

Nichols recommends testing the assembled beam on the ground, before you put it up on the tower. He suggests aiming it skyward, with the reflector element supported about a foot above ground, and applying enough power to check the SWR. You should see no more than a 1.5:1 SWR at this stage. The SWR will drop to about 1.2:1 when the antenna is raised to operating height.

Since the assembly dimensions are so easily followed (no fractional measurements), I simply re-checked all my figures and bypassed the ground testing phase. When placed above my tribander at 65 feet, I found my SWR figures were essentially flat over both bands at the first crack.

Now a word about the size and appearance of this beam. On the ground, the beam looks ungainly. The reflector is 26′4″ long, and the driven element is 24′6″. They are spaced just under 8 feet apart. The antenna gives the impression of being all elements and no boom. However, it is quite well-balanced, and it loses its ugly duckling appearance as soon as it goes up on the tower.

The total weight of the antenna is just 16 pounds, and it presents only 2 square feet of windloading. This makes it an ideal candidate for stacking above a moderate sized tribander. KD9SV recommends that it be stacked about eight feet above an existing array. In my case, at five feet of separation I have found no detuning effects on either the dual-bander or my existing tribander.

The boom is supplied with the kit. U-bolts that will accept a mast up to 2″ in diameter come with the kit.

Performance

No antenna review is complete without a paragraph or so on results. For each of us, the bottom line is how the antenna performs in real life.

The KD9SV beam *works*. Over the year that I've used it, it has given me absolutely trouble-free service. The reports I receive are all excellent. I enjoy DXing on 17 meters a great deal, and this beam has made the chase all the more worthwhile. There is a great deal of satisfaction in being able to break a pile-up on the first call, and this antenna has provided me with that thrill on numerous occasions.

And stateside rag-chewing is a lot more pleasant when you're not getting kicked around by QRM, too.

Because of its inherent simplicity of design, top quality compoments, ease of assembly, and high performance, the SV Products model 1824/2L beam is a highly recommended buy. 73

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by J. Frank Brumbaugh KB4ZGC

Operation during emergencies, on camping trips, or on Field Day often requires the use of less than optimum antennas. The usual wire dipole needs an antenna tuner for multiband operation, is somewhat bulky, and is subject to tangling. Separate dipoles for each band further multiply these problems. Hams living in apartments or condos who are restricted to indoor antennas especially need a better way to get on the air with an efficient antenna, but one which is not generally noticeable to the eye.

How about an antenna that covers 40 through 10 meters, is small and portable, weighs but a few ounces, is ideal for apartment or attic installation, is almost invisible when erected indoors, and can be built for $5?

The Antenna

The seven-band multiple dipole described in this article is a full-sized dipole for all bands from 40 through 10 meters. It fits in your pocket and can be erected in a few minutes. Neutral in color, it can be tacked to a wall or ceiling, ends bent as required, yet remains practically invisible to the casual visitor when used in an apartment. It is especially handy for traveling hams staying in motels.

The secret of this almost invisible antenna is the use of seven-wire flat ribbon cable. You can buy a 100-foot reel of gray ribbon cable from All Electronics Corp., P.O. Box 567, Van Nuys CA 91408 (catalog no. RCBL-7). This flat cable is less than ⅜ inch wide, making it very light and easy to erect indoors using staples or thumbtacks, or outdoors tied to trees or other supports, and equally easy to take down. With both halves rolled, it makes a package 5 inches in diameter and ¾-inch thick, easy to fit into a jacket pocket or tuck into the corner of a suitcase when traveling. The cable resists tangling because it is flat, making installation and operation much easier.

Construction

See Figure 1. Separate the seven wires for about 2 inches at one end of the cable, then strip the insulation from all seven. Twist the bared wires together and solder. This will be the feed point of one half of the antenna.

Next, measure 32 feet 8 inches from the end of the insulation at the soldered end of the cable. Cut the cable at this point. Now, repeat this entire procedure to produce another length of cable for the other half of the antenna.

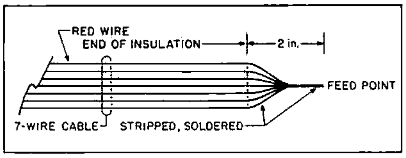

Figure 1. Feedpoint details. Strip 2 inches off of the end of the wires, twist them together and solder.

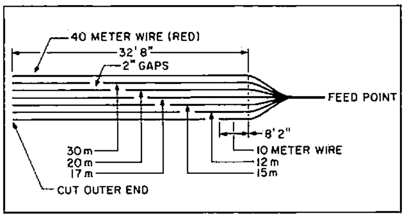

Figure 2. Construction details of the seven-band antenna. Two inch gaps are cut into the cable to isolate each resonant dipole element.

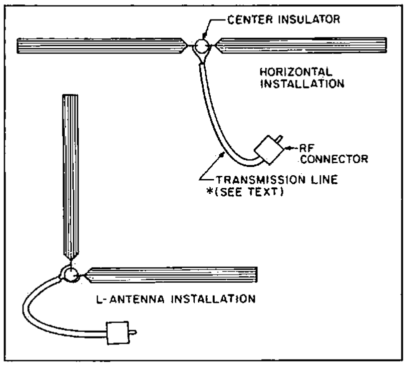

Figure 3. The completed multi-band antenna showing suggested installation configurations.

Note that the cable has the wire at one side colored red. With this wire as the 40 meter antenna, the outside gray wire across the cable will be the 10 meter antenna. Measure 8 feet 2 inches from the end of the insulation at the feedpoint. With a pair of diagonal cutters, **very carefully** cut the outside gray wire at this point, forming one half of the 10 meter antenna. Now, pull about 2 inches of the outer portion of the gray wire at the cut point loose from the cable. Cut off this short piece of wire and discard it. **Do not loosen or cut the 8-foot-2-inch wire!**

Measure 15 inches from the cut end of the 10 meter antenna on the adjacent (second) gray wire. Cut this wire carefully and remove about 2 inches of the wire towards the far end of the cable, as described above. Use a sharp knife to split the insulation between the wires on each side of the wire to be removed. This makes it easy to snip out the short length to separate the 12 meter antenna from the rest of the cable.

Measure 19 inches from the cut end of the 12 meter antenna towards the far end of the cable. Mark the third gray wire at this point. Separate and remove a 2-inch piece of wire as described above, forming the 15 meter antenna.

Measure 2 feet from the cut end of the 15 meter antenna on the fourth gray wire. Mark the wire at this point. Separate and remove a 2-inch piece of wire as described above. The fourth gray wire just prepared is the 17 meter antenna.

Measure 3 feet 6 inches from the cut end of the 17 meter antenna and mark this point on the fifth gray wire. Separate and remove a 2-inch length of wire, as above. This fifth wire is the 20 meter antenna.

Measure 6 feet 6 inches from the cut end of the 20 meter antenna, as above. Mark, cut, and discard a 2-inch length of wire from the outer part of this sixth wire. This is the 30 meter antenna.

The remaining red seventh wire is the 40 meter antenna, and is already cut to the proper length.

Now, prepare the remaining 32-foot-8-inch length of cable as just described. This forms the remaining half of the seven-band antenna.

Both lengths of cable should be identical and look like Figure 2. The 2-inch gaps in the six gray wires must be in the same places on both antenna halves. These gaps separate the outer ends of the 10-through-30 meter antennas from the unused lengths of wire in the outer portions of the cable. The wires are retained to maintain strength and flatness in the cable when the antenna is erected.

Feeding the Antenna

Depending upon how and where this antenna will be used, the center insulator attaching to the two halves at the feedpoint can be anything from a piece of string, a coat button, or even a standard ceramic or plastic antenna insulator. The transmission line for the antenna can be made of speaker wire with a clear insulation, alarm or intercom twisted pairs, the remaining, unused length of cable still on the reel, or you can use RG-8X or RG-174/U coax.

Radio Shack has a two-conductor speaker wire with clear insulation (RS 278-1301) in 50-foot rolls for $2.99. They also sell two-conductor twisted pair alarm wire (278-860) in 100-foot rolls for $5.99. However, making your transmission line from the remaining cable is cheaper, and will be less visible in indoor installations.

Making the Transmission Line

If you wish to make the transmission line from the remaining length of seven-wire cable, strip the needed length of three adjacent wires from the remaining four wires so you have two pieces of cable. The one you will use is the three-wire section.

Separate all three wires at one end of the transmission line and remove the insulation from the two outer wires for about 2 inches, depending on the length of the center insulator used at the feedpoint of the antenna. Now cut off and discard the short length of the center wire.

Only the two stripped outer wires will be used for the transmission line. They approximate a 72Ω line. The unused center wire maintains the constant spacing and provides additional strength to the transmission line.

Connect the stripped bare wires at the end of the transmission line to the bare ends of the antenna halves at the feedpoint. Solder both connections.

Prepare the other end of the transmission line in the same way, again removing the unneeded short length of the center wire. Now, solder the ends of the transmission line to an RF connector which matches the output connector on your transceiver or antenna tuner.

Erecting the Antenna

You'll find this antenna to be extremely portable. It rolls up into a nice compact package. When operating outdoors just find some cooperative trees to support the antenna and you're on-the-air.

The following are some hints for indoor installations in a motel room, apartment or condo.

The best and most inconspicuous place to mount the antenna is on the longest wall available, centered, or with the feedpoint at one corner to form a vee shape, which will give slight directivity. Whichever method is used, the antenna should be snugged up against the ceiling. The red 40 meter wire should be at the upper edge of the cable, making it less obvious. Because adults very seldom look above their own eye level, few visitors, including landlords and building managers, would even suspect the existence of your antenna. And, if you use white or clear glass or plastic coat buttons as a center insulator, your antenna will, for all practical purposes, be invisible.

Attach the antenna to the wall with office staples. They are wide enough to span the width of the cable without penetrating it. If you use thumb tacks, be sure that the metal tack does not short the actual antenna wires. If neither is available and you are in a hurry, cellophane tape used generously will probably hold the antenna up for a while. However you mount the antenna, it will be easy to strip it from the wall later. Pulling it loose will leave only tiny invisible holes as evidence.

As much as possible of the central portion of the dipole should be horizontal, but bending the ends to fit the available space will not greatly affect the operating efficiency of the antenna as long as the ends are not bent back parallel with the horizontal portion. Considering the height of the ceiling in most indoor locations, this antenna can also be used as a vertical-horizontal L-antenna, especially on 15 through 10 meters (see Figure 3). Simply tack the feedpoint in one corner of the room, roll out the horizontal leg along one wall, and tack the vertical portion at the top of the wall, and also on the ceiling if the end must be bent because of low ceiling height.

If you do not need 40 and 30 meter capability, you can shorten this antenna considerably, making it much easier to install indoors. However, it is not necessary to remove the 30 and 40 meter wires. This antenna provides full-size dipoles on all seven bands, whether you use them or not.

Performance

This antenna is not as efficient as 50-foot high individual dipoles erected outside. However, it will give a good performance in operation on all seven of the ham bands for which it is designed.

If an SWR of about 1.5:1 is acceptable—most modern transceivers will operate successfully into this high an SWR—you won't need an antenna tuner, but if there's one available you'll probably want to use it.

The transmission line will probably radiate some of the power supplied to the antenna. So what? Radiated RF goes somewhere, and it may well fill out a "blind spot" and result in contacts otherwise missed.

A dipole is not an especially directional antenna. This is particularly true when the dipole is either fairly close to ground or installed in the vicinity of hidden wires and pipes in indoor or outdoor walls of a motel room or apartment. These elements distort the free space doughnut radiation pattern shown in antenna literature. But, this project will give you a simple and effective seven-ham-band multiple dipole which is easy to build, install and use, light and portable, and at a cost of only $5, is within the budget of probably every ham. 73

Contact J. Frank Brumbaugh KB4ZGC at 82 Liddell Street, Buffalo NY 14212-1824.

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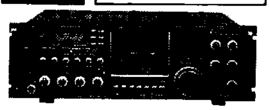

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Ten for 10

Build a high performance, 10 meter beam for $10.

by Michael Harris KM4UL

I have always enjoyed home-brewing ham radio equipment, and especially antenna projects, because the components are relatively inexpensive and the results are tangible. My wife says that I build and tinker more than I operate. Guilty as charged!

This article is a result of my tinkering, providing a practical example of constructing an X-beam for 10 meters. The antenna uses components commonly available in hardware stores, but it's also very inexpensive even if you have to buy all the materials. I purchased the primary components at my local hardware store for less than ten dollars.

I got into this project because I couldn't establish a schedule with Robin N7NHF in Idaho. His vertical and my delta loop weren't reliably making the trip. After discussing the matter, we decided we needed to improve our antenna situation.

Robin had both an interest and local expertise with quads, so he began his project. I remembered an interesting article, "Designing X-Beams" by Brice Anderson W9PNE in *The ARRL Antenna Compendium, Volume 1*. This article also appears in *The ARRL Handbook*, 67th edition (1990), Chapter 32, "Designing X-beams." The X-beam promised good performance and appeared to be relatively easy to construct. The article discusses design, construction, and tuning in general, but does not focus on a particular design. I picked up the ball from there and the result is an operational X-beam, a regular schedule with Robin, and this article, an explanation of how to duplicate the antenna I built. It contains construction alternatives and hints on prototyping.

Performance

The design article claims gain figures of 6 dBd and a front-to-back ratio of 15–18 dB. What I noticed was an improvement from "headphone copy" to "solid copy" during my schedules with Robin. Good enough for me!

Several hams have mentioned reading "bad things" about X-beams, frequently referring to L.A. Moxon G6XN's *HF Antennas for All Locations*, Chapter 5, "X-Beams and Slopers." These "bad things" relate to getting an acceptable pattern and a characteristically low feedpoint impedance.

The general problem of X-beam patterns was solved in Brice's design by adding the tails. These effectively prevent side lobe radiation and provide a good pattern.

Photo A. The completed X-beam.

The problem of low feedpoint impedances is common to all antennas with close-spaced elements—including yagis. The antenna exhibits a feedpoint impedance of approximately 10 ohms. This is easily matched by techniques commonly used to feed yagi antennas. I used a "Collins balun" as described by George Badger W6TC in "A New Class of Coaxial Line Transformers," *Ham Radio Magazine*, February 1980, Part 1; and Part 2, March 1980. I describe construction of a suitable transformer in this article. I highly recommend this class of coaxial baluns for all antenna work.

I have performed extensive computer modeling of this antenna using MININEC3 (J.C. Logan and J.W. Rockway, *The New MININEC, Version 3: A Mini-Numerical Electromagnetic Code*, NOSC Technical Document 938, National Technical Information Service, 1986). This modeling confirms the gain figures reported by Brice, the effectiveness of the tails, and the feedpoint impedances. The general predictions of the computer modeling have been confirmed by antenna measurements and in-service observations.

Materials

I enjoy reading articles about how somebody built this or that with some exotic material or tool they just happened to have around,

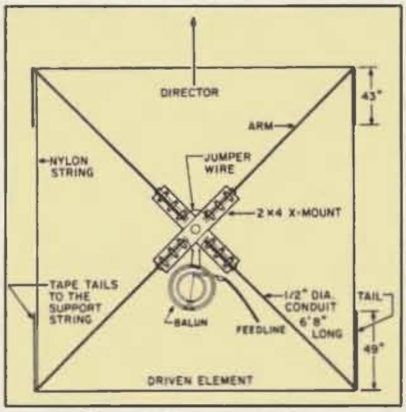


Figure 1. X-beam overview.

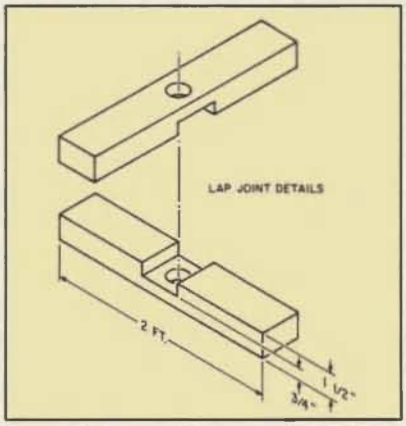


Figure 2. Lap joint for assembly of the X-mount.

but I've never been that fortunate. Fear not—this antenna can be readily constructed using common materials such as wood, steel conduit, and PVC pipe.

I bought the conduit, the PVC pipe, the pipe clamps, and the two-by-fours for less than ten dollars. The miscellaneous hardware alone, if purchased, should cost only a few dollars.

Antenna Components and Construction

The electrical components of the antenna consist of four tubular arms with a wire tail attached to the end of each one. Two arm assemblies are connected and tuned to form a director element; the other two are tuned and form the driven element.

The mechanical components of the antenna consist of a small X-hub in the center, along with a cord which strings the arms together. The hub supports the radially configured arms, and the cord supports the tails in the same plane as the arms. The electrical components of the coaxial transformer consist of six 50" pieces of 50 ohm coax.

The Hub

I built my hub with two 2' pressure-treated two-by-fours. Join them at the center with a lap joint (see Figure 2). Cut the lap joint with

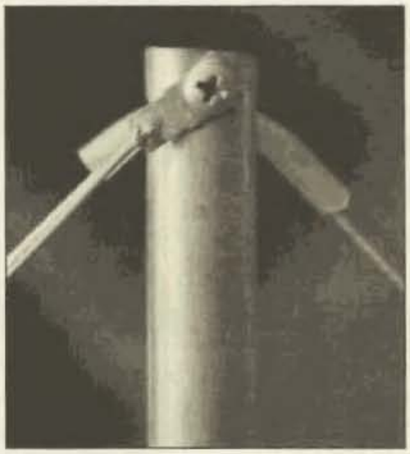


Photo B. Tail attachment and support method. Note the use of silicon tubing to protect the tail support cord.

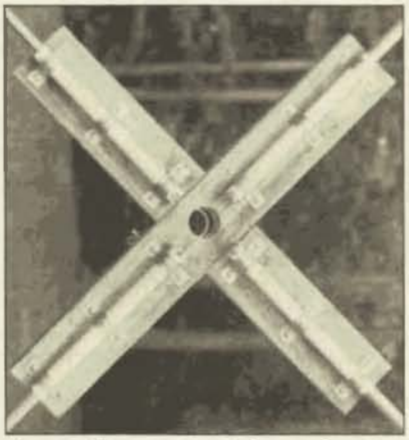


Photo C. The completed hub assembly of the antenna, prior to installation.

a saw and chisel or with a dado blade. Join the pieces with screws and epoxy or waterproof resin glue. Cut a hole in the center to accommodate the mast.

As an alternative, especially for prototyping, substitute a piece of plywood for the two-by-fours. Use exterior plywood and varnish it. I chose the two-by-fours so that the hub wouldn't ice up as much.

The Arms

My local hardware stores don't carry 6061-T6 aluminum, but they stock a nice selection of steel conduit. For this antenna, the steel conduit is an acceptable substitute. The ½" size is close enough to the 200-to-1 length-to-diameter ratio specified in the design article.

Buy four 10' lengths of ½" EMT conduit. Cut each piece to 6'11" with a hacksaw. Clamp the conduit to your workbench and drill a vertical hole at each end to accept the electrical connections.

The Tails

My installed antenna uses #19 AWG stranded hookup wire for the tails, but I've also used #12 AWG home-wire. The wire size will affect the length of the tails required to achieve resonance. The smaller the wire, the longer the tail. I prefer the larger, more solid wire as it remains straight even if the support cord shifts or stretches.

For a center frequency of 28.3 MHz, cut two director element tails, each 43" long, and two driven element tails, each 49" long. These lengths provide about 2" extra for tuning if #19 AWG wire is used. Solder a wire terminal to one end of each wire.

The most important consideration is to always maintain a difference of 6" between the driven and the director tail element lengths. Using two different colored wires for the driven and director element tails can help to reduce confusion later.

The Tail Supports

The tails must be supported in the same plane as the arms. I used 3/32" nylon cord threaded through holes drilled in the end of each arm. I used silicon tubing to provide strain relief for the cord.

Put the tail support holes 90 degrees and ½" in from the hole drilled for the electrical connection. This inset prevents the nut and bolt from touching and rubbing through the tubing.

Drill the tail support holes at one end of each arm using a ¼" drill bit. De-burr the holes with a piece of emery cloth. Cut four 2" pieces of silicone tubing and set them aside. Do not install the tubing until after the arms are insulated and installed. Silicone tubing is sold at aquarium shops as airline tubing, and at hobby shops as fuel tubing. Dacron™ or Kevlar cords are preferable, as they weather well and won't stretch as much as nylon.

Insulating the Arms

The arms should be insulated from the hub for consistent performance. I used ½" type SDR PVC pipe (not schedule 40). It provides

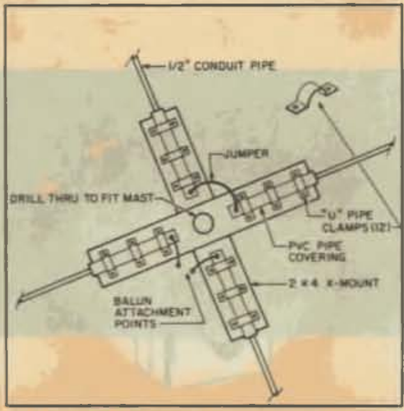


Figure 3. X-mount construction details.

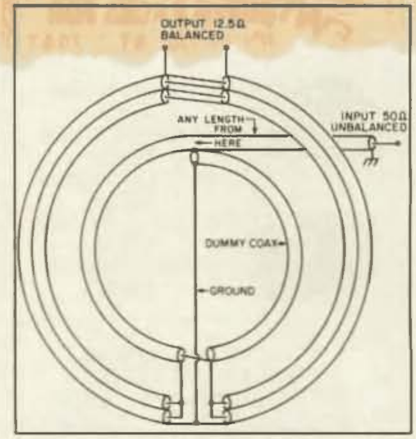


Figure 4. Collins balun.

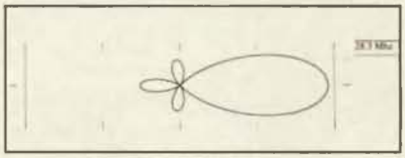


Figure 5. X-beam pattern.

a good, albeit tight, fit around ½" EMT conduit.

Cut four 11" lengths. The fit is very tight, so use warm soapy water as a lubricant. Start a length of PVC over the inside end of the arm. Install it fully by repeatedly driving it against a concrete floor. Repeat this procedure for the remaining arms. Substantial force can be used without damaging the PVC. Sanding the conduit may help, but be careful not to sand through the zinc coating.

Open up the electrical connection holes you drilled by cutting away some of the PVC. I used a ⅜" spade wood bit in my drill to shave it away. You can use a knife, but the PVC is difficult to cut.

Building the Coaxial Balun

This Collins coaxial balun consists of two stages. The first stage matches 50 ohms unbalanced to 50 ohms balanced; the second matches 50 ohms balanced to 12.5 ohms balanced. Use a compact low-loss coaxial cable such as RG-8X—this balun is bulky.

Build each stage separately, then solder them together in series. To prevent confusion

later, mark the ends of the lengths of coax before you begin winding them. Keep the interconnections short. Use the coaxial braid at the 12.5 ohm output to connect directly to the antenna feedpoints.

Figure 4 shows the interconnections and layout as if the balun wasn't coiled. In practice, the lengths are wound into a coil with a diameter of six or seven inches. This diameter isn't extremely critical; it depends on the coaxial cable you use. The ground wire should be short, but its length isn't critical, either. The dummy length of coax in the input stage can be replaced with a wire, provided it is the same length (50"), and is wound in the same manner.

Use electrical tape to hold the windings together—sparingly during construction, and with a vengeance prior to installation. Waterproof the balun by using a polyurethane spray or a silicone rubber compound.

Putting it Together

Prepare the hub. (Refer to Figure 1 and Photos B and C for detailed views.) Start by marking a centerline on each two-by-four. Next, place the pipe clamps. I used three pipe clamps per arm: one at each end, and one in the middle. Be sure to use the proper type of clamps—½" electrical clamps for clamping conduit directly, and ½" plumbing clamps for clamping the insulated arms. Locate the inner edge of each innermost clamp 1¾" from the center to provide clearance for the mast. Drill pilot holes for the clamp screws. Install the clamps loosely.

Install the arms by slipping each arm, in turn, under the clamps, then snugging the clamps. Allow the inner end of each arm to extend ½" beyond the edge of the inside clamp. This provides access to the end of the arm for electrical connections. Clamping the hub to a workbench or your deck reduces the number of hands required for this procedure. Rotate each arm to properly align the electrical and tail support holes, then tighten the clamps securely.

Next, attach each tail loosely to the arm. If possible, use stainless hardware. Be sure to install the director element and driven element tails properly. This step is best performed before you install the tail support tubing.

To support the tails, install a 2" piece of silicone tubing through the hole at the end of each arm. Thread the tail support cord through each arm in turn. Pull the cord tightly, as it will sag when the tails are attached. Line the tails up along the cord and secure them at several points with electrical tape. Tighten the tail-to-arm connections securely.

To wrap it up, connect the director element arms. I used a short piece of #12 AWG copper wire. Coax braid will also work well.

Feeding the Antenna

The feedpoint impedance of this antenna is 10 ohms at resonance. With proper matching to 50 ohm coaxial lines, this antenna provides a 2:1 VSWR bandwidth of about 600 kHz on 10 meters.

For my prototype antenna I used a coaxial "choke" balun consisting of 10 turns of coaxial cable wound into a 6" diameter loop. I matched the transceiver to the line using a transmatch.

For my installed antenna I used the two-stage Collins balun described in this article. This balun provides a 12.5 ohm balanced to 50 ohm unbalanced transformation. A 2:1 VSWR bandwidth of 600 kHz is exhibited without the use of a transmatch.

I strongly suggest the use of a balun, and I heartily recommend the Collins class of baluns, but the coil-of-coax type will work in a pinch.

Tune-Up

Install the beam on your test tower. I used an 8' wooden ladder for my test tower. It's high enough off the ground, yet access to the tails is convenient.

Tune-up is accomplished by trimming the tails. Be sure to keep the director element tails and the driven element tails the same lengths, respectively. Also, be sure to maintain a difference in length of 6" between the director element tails and the driven element tails.

Use a dip meter, noise bridge, or SWR meter to test for resonance. I borrowed a dip meter for the tune-up procedure. If you use a dip meter, be sure you are familiar with its limitations. During my tests, I found that the antenna was resonant at a frequency 5% higher than that indicated by the dip meter.

Proceed by trimming the tails ½" at a time, testing for resonance until the correct resonance is achieved. Note that the antenna is fairly sensitive to nearby objects, such as your body.

Perform the final tune-up with the antenna installed. I ended up with director element tail lengths of 41", and driven element tail lengths of 47", for a resonance at 28.3 MHz.

Prototyping

This is a very easy antenna to prototype. The difference between my prototype and the installed antenna was about $3, plus an hour of labor.

I prototyped mine by directly clamping the conduit to a scrap piece of wood. I attached the wire tails with ground wire clips, supported the tails by taping them to a cord drawn around the perimeter, and made the connections at the hub by clamping the wires under the pipe clamps. I completed my "installation" by clamping it to an 8' wooden ladder in my living room.

Installation

I installed the beam at the base of the top section of my 36' push-up mast, inverting the beam and attaching it to the underside of the guy ring. I had to do this to prevent mechanical interference between the hub and the clamp for the top mast section. I did not have to worry about interfering with guy wires, as my mast is not guyed. The mast's sheltered location, light antenna load, and mechanical attachment to the house, precluded the need for guy wires.

To prevent rotation about the mast, I fashioned two L-shaped pieces of plumber's metal strapping and screwed them to the guy ring. I secured the assembly to the mast with a hose clamp. This is adequate for me, as I don't have a rotor, and I am using the antenna for fixed direction schedule work. As an alternative, especially if you are using a rotator, use a heavy-duty L-bracket with pipe clamps that fit your mast.

Complete the installation by securing the balun to the mast. I wound electrical tape through each stage of the balun, and around the feedline below the balun.

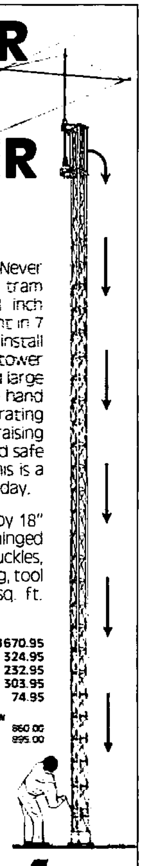
I'm confident that you'll find this to be a compact, high performance beam which is easy to build and won't lighten your pocket book. Enjoy it! Be sure to remember that "59" means "armchair copy" and "20 over 9" means "You woke up the kids." You'll be hearing this new jargon often!

Contact Michael Harris KM4UL at 5917 Crabapple Rd., Durham NC 27712.

Parts List

4	10' lengths of ½" EMT conduit
1	10' length of ½" SDR PVC pipe
12	½" plumbing pipe clamps
1	8" length of silicon tubing
4	4' lengths of wire scraps
2	24" lengths of pressure-treated two-by-four
6	50" lengths of coax (RG-8X preferable)
	Misc. Hardware as required

Enjoy NEVER CLIMBING YOUR TOWER AGAIN



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HAMS WITH CLASS

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A Family Affair

"How can I get my own children interested in ham radio?" is the second most-frequently asked question. You've probably guessed that the most popular query is still, "How can I get my wife to become a ham?" Let's address the offspring problem in this column now. We'll save the spousal issue for another time.

Helping parents and children work together on any project is a worthwhile endeavor. Throughout the last 10 years of teaching ham radio, I've always encouraged the youngsters to study at home with their parents. The parents love the idea of learning new material along with their children. Here at last is a subject where parents and children can be on equal footing with each other. It's a chance for real active participation in their children's academic lives. Most parents are quick to see the benefits of encouraging their youngsters to get involved with a technical and stimulating hobby.

In order to motivate the 6th, 7th, and 8th graders in my "Introduction to Amateur Radio" classes to include their parents in their own quest for a license, I tell them to "study at home with the person who has the money. If your mom or dad gets a license too, they'll probably buy ham radio equipment for your family to use." The kids love the idea that they're putting something over on their folks. Years later, when I get the siblings of these children in my class, they come back with their parents during Open School Week to tell me how much ham radio has contributed to the quality of their family-time together. The burden then falls to the young sibling in my class to carry on the family tradition. I've gotten enough positive feedback about the fun that ham families have, that I make it a point to encourage it whenever possible.

Getting back to the original question, many hams have written to me over the years, perplexed at why their own youngsters don't seem to share their love of amateur radio. Of course, those of us who are parents know all too well that sometimes the more we encourage, cajole, or bribe our kids to do something that we'd like them to do, the more they pull away from it. Some degree of rebellion is a natural part of growing up. Children have a need to assert themselves and establish their own identity. Much to our chagrin, at times this means rejecting whatever mom and dad may consider a real good idea.

Through the trials and tribulations of child rearing, there are many proud and happy moments that help counter the negatives. Keeping all this in mind, the best advice to a ham parent is not to use overkill when attempting to convince your children to become hams. Just be yourself and let the youngsters see you enjoying your time on the radio. Enjoyment and enthusiasm tend to be contagious. Never underestimate the vibes that children pick up as they watch you having fun and being challenged by your radio activities. There's a time when the smile of satisfaction or the expression of excitement on your face says a lot more than any words you can say.

Among the countless benefits I've experienced in my role as a ham radio teacher has been the privilege of having children of hams in my class. Don't think for one minute that these parents had an easy time of it. Not one of the nine youngsters in this category were licensed when they were assigned to my class. That should tell you something right there. Another statistic is that they all became licensed at the end of the program. There are simply times when an eleven-year-old thinks it's OK to do something because their peers are all doing it, not because a parent would be overjoyed to have them do it.

The following are stories of some boys and girls whose parents were ready to move heaven and earth to get them involved in ham radio. They wound up in my ham radio program which provided them with the opportunity to be in a class with other children who were eager to get a ham ticket. Working and having fun with other teens was just the extra motivation these kids needed. Before we knew it, they were going home and proudly reporting their new-found radio experiences to their ham parents. At first the dads were surprised that the children acted as if it were their first exposure to ham radio. Then they realized that this was just the kids' way of asserting their separateness. Smart parents should listen attentively to their children's reactions and anecdotes. Encourage them to tell you about their experiences with the other students. We all need to feel we have something unique to offer our families.

So, getting your offspring enrolled in a local ham radio class in a school or club is a great idea. Don't ever assume there's a genetic predisposition to becoming a ham. Set the stage with your own enthusiasm and then encourage them to go with a friend to a structured class. You've already planted the seeds; now sit back and let nature take its course—with the help of an objective, good ham radio instructor.

Gerald D. Fox, D.D.S., WA2VKS

"One hundred baby chicks!" That's what the man said. I was 12 years old; it was late at night in 1960, and I was lying in bed listening to WWVA on the radio, all the way from West Virginia. The commercial on the radio reminded me of how different life in other parts of the country must be from my life in New York. What would a city boy do with a hundred baby chicks?

Photo A. Jerry Fox WA2VKS visits his daughter, Loren KA2JNV, at the school ham shack.

That summer, I went to my friend Larry's house to sleep over. Larry reached under his bed and pulled out a shortwave radio. Voices from other lands speaking many languages filled my ears. Larry tuned around the dial and suddenly the voices sounded different. I wasn't hearing polished, professional broadcasting. This was conversation. These people were talking to each other. Then I heard a British accent; people were talking across the ocean! I was hooked.

The next summer I went to a camp, and I was delighted to discover a new activity. The camp had a ham shack, complete with a Gonset "gooney box." Myles, the counselor, taught me code and theory, and that summer I passed my Novice test.

Ham radio has stayed in my blood. I worked my way up the ladder, getting each class of license, including amateur Extra. It was time to pass it on!

I now have a 12-year-old daughter attending Intermediate School 72 in Staten Island, New York. You can imagine how thrilled I was when I found out that they had a ham radio program. I met Carole Perry, the instructor, whom I'd spoken to many times on 2 meters. I knew my daughter would have to take this course!

Carole made it fun. Loren called me at work each day and told me what she'd learned. Hearing of her progress almost made me cry. The class has both an HF and VHF setup, and I had the pleasure of talking to Loren in class via the local repeater.

Loren did get her Novice license after studying in Carole's class. She is still a little mike shy, but she told me today she'd like to get some practice on the air. You know, I loved it!

Shaun Gartenberg KB2JNW

I am a 13-year-old amateur radio operator. Both of my parents are hams as well. My father, Martin Gartenberg WA2YYX, has been a ham radio operator for about 30 years. He was introduced to the hobby at an early age by a friend. He holds a Technician class license, and is active in several Staten Island radio clubs. He was also president of the Chaverim Radio Club in Perth Amboy, New Jersey. He's been good friends with Mrs. Perry for over eight years. He was always telling me how much fun it would be to get into her ham radio program when I went to Intermediate School 72. He was right!

My mother, Rachelle Gartenberg KB2DBF, has been a ham for two years. She was introduced to the hobby by my father who helped her study for the Novice license. She is a schoolteacher who plans to upgrade in the near future.

Photo B. The Gartenbergs, left to right: Marty WA2YYX, Shaun KB2JNW, and Rachelle KB2DBF. (Photo by Jay Gerstel KA2CUS.)

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Photo C. The Tropps: Charles N2CDV, Laura KA2WUH (in the middle), and Deborah KB2KXU

Photo D. Lori Perry KA2TCC and Carole Perry WB2MGP.

I became a ham in January 1990, and I love it. It's an interesting and exciting hobby. I was in Mrs. Perry's radio class when I was in the 7th grade. It was here I found out how much fun my friends and I could have in ham radio. I'm a Novice now, but I'm studying for my upgrade. This year as an 8th grader, I'm in Mrs. Perry's homeroom class. Many of the other students in this class are hams, too. It's great in the morning when we're in homeroom. We're right near the ham shack. Not only is it fun to talk on the air in the morning from school, but in my case, it's great because I can talk to my dad. He's so proud of me.

I have a 9-year-old sister named Meredith. She's not a ham yet, but my parents and I are sure she will be in the future.

Charles Tropp KA2AHA

Although interested in ham radio since grade school, I didn't get my first license with callsign KA2AHA until 1978, after completing an adult education course at Susan Wagner High School. I started operating in the spring of 1979, and I got my General license as N2CDV in 1980. Laura KA2WUH received her Novice license as a student of Mrs. Carole Perry in 1985 at I.S. 72 on Staten Island. Deborah KB2KXU got her Novice license in 1990 also at I.S. 72. Our station consists of an ICOM 751 and a dipole at 40 feet. We also have 10 meter FM capability, and we can operate on all HF bands. We enjoy being a ham family.

Lori Perry KA2TCC

My name is Lori Perry, callsign KA2TCC, and I'm 20 years old. Nine years ago I attended Intermediate School 72 where my mother taught a ham radio course. At first I was mortified to learn that several of my friends were going to be in my mother's class. For years, my mother tried to get me involved with her hobby. Actually, it wasn't until my friends started talking about it that I began to consider it seriously.

Today I'm a communications major at Hofstra University. Ham radio has been influential for me from the moment I went for my entrance interview, to my present choice of media courses. The woman who interviewed me spotted an HT antenna sticking out of my bag and asked about it. In retrospect, it was obvious that she was impressed.

I haven't been very active in the last few years, but I am very pleased and proud to be a ham. There have been many family activities, like vacations and trips, where it was really nice to have a ham for a mom. ■

Number 18 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

APRIL

CAMILLUS, NY VE Exams will be held the first Friday of each month at the Town of Camillus Municipal Building, 4600 W. Genesee St., Camillus NY, beginning at 7 PM. Test fee for Technician through Extra Class is $5.25. Talk-in on 147.300. Contact *John Patchett KB2ERJ, (315) 487-0298.* Please bring two forms of ID and a copy of your license.

APR 6

ROCHESTER, MN The 14th annual Rochester Area Hamfest/Computer/Electronic Show, sponsored by the Rochester ARC, Inc., will begin at 8:30 AM. Tables are $8 in advance, $9 at the door. Set-up Fri., Apr. 5th from 4:30–7:30 PM and Sat. from 6:30–8 AM. Contact *John Scott NØHZN, (507) 285-9236.* Send check and SASE to *R.A.R.C., c/o NØHZN, 2824 NW 24th St., Rochester MN 55901.*

COLUMBUS, IN The Columbus ARC will sponsor a Hamfest at the Bartholomew County 4-H Fair Grounds Women's Building from 8 AM–2 PM. Set-up Fri., Apr. 5th from 6–10 PM and Sat. from 6 AM. Admission $3. Tables 8'/$6. Talk-in on 146.790/146.90. For reservations: *Marion Winterberg, 11941 W. Sawmill Rd., Columbus IN 47201, (812) 342-4670.*

APR 6-7

SPOKANE, WA The 14th annual Inland Empire HamFest/Eastern Washington Section Hamfest will be held at the Spokane Youth Sports Bingo Hall from 9 AM–5 PM Sat. and Sun. Set-up Fri., Apr. 5th from 1 PM–6 PM. On site breakfast starting at 6:30 AM. Admission $5 for both days. Children under 12 free. License Exams Sat. beginning at 1 PM. Sat. night Awards Dinner ($9.15 per person) 7 PM at the Town & Country Restaurant. Swap tables: $10/8', $8/6'. Table registration deadline is Apr. 1st. Make check payable to: *I.E. Hamfest, S. 1405 Crestline, Spokane WA 99203.* For info call *(509) 534-8443.*

MOORELAND, OK The Great Plains ARC will host the annual N.W. Oklahoma Eyeball and Swapmeet at the Mooreland Agricultural Bldg., beginning at 12 noon Apr. 6th, and at 9 AM Apr. 7th. Admission $3 for both days. Basket Dinner at 12 noon Apr. 7th at no charge. Free dealer and swap tables. Talk-in: 147.12/.72 or 146.13/.73 and 146.52 simplex. Contact *Gerald Bowman WG5Z, Box 356 Mooreland OK 73852. (405) 994-5453 or Bob Bayless. (405) 254-3561.*

APR 7

ST. JOSEPH, MI The Blossomland ARA will sponsor a Hamfest beginning at 8 AM at the Berrien County Sportsman's Club (take I-94 to Exit 28, south on US 33 for 6½ miles to Linco Rd. and turn left to end of road). Set-up at 6 AM. Handicap access. Free parking. Tickets $3 in advance, $4 at the door. Reserved tables $4, $5 at the door. Registration deadline Mar. 25th. Talk-in: 145.47 and 146.82. Send SASE to *BARA, PO Box 175, St. Joseph MI 49085.*

APR 12-14

VISALIA, CA The Northern California DX Club will host the 42nd International DX Convention at the Holiday Inn Hotel beginning Fri., Apr. 12th at 1600 local time. Fri. night Bar-B-Que and Sat. Banquet will be preceded by cocktail parties, with breakfast at 0800 Sun. Preregistration is $45 US before Mar. 15th, $50 at the door. Includes banquet, breakfast and all programs/exhibits. Contact *General Chairman E.D. Stephenson W6MKM, 230 W. 42nd Ave., San Mateo CA 94403 (415) 341-0757.*

APR 13

LEBANON, PA The Appalachian Amateur Repeater Group will sponsor the Annual AARG Hamfest/Computer Show at the Lebanon Fairgrounds beginning at 8 AM. Admission $4. (XYL's, YL's and kids free) Set-up at 6 AM. Handicap accessible. VE Exams at 10 AM (be there by 9:30 AM) Lateness results in disqualification. Tailgating, $3/space. Indoor tables $8. Talk-in: 146.04/.64 and 146.52/.52. Make registrations payable to AARG and mail to *AARG, Ron Wiggins WB3HNX, R.D. #4, Box 374, Pine Grove PA 17963.* Contact *Ron WB3HNX, (717) 345-8667; Homer WA3YMU, (717) 345-3780; Willie KA3MVM, (717) 273-6334.*

LAWTON, OK The Lawton-Fort Sill ARC will hold their 44th annual Hamfest at the County Fairgrounds from 8 AM–5 PM. No preregistration necessary except for table space. Talk-in on 146.91/.31. Contact *Bob Morford, 1415 NW 33rd, Lawton OK 73505. (405) 355-6120.*

CHESAPEAKE, VA The Chesapeake ARS will host a Hamfest at the Indian River Recreation Community Center from 9 AM–3 PM. Wheelchair accessible. VE Exams sponsored by the Chesapeake DX Assn. ARES Forum. Admission $3. All tables $5. Set-up Fri. Apr. 12th from 6 PM–9 PM. Dealer contact *Frank KN4QG, (804) 588-0403 or Chuck N4NIG, (804) 482-0842.* Flea Market contact *Rob N4SFH, (804) 487-1896 before 10 PM.* Reservation deadline Apr. 1st.

FERGUS FALLS, MN The Lake Region ARC will sponsor their 4th annual Hamfest from 8 AM–3 PM at the Otter Tail County Fairgrounds Hockey Arena. Set-up Fri. the 12th at 4 PM. Security provided Fri. night. Camping spots for Fri. night only. Tickets $3 in advance, $4 at the door. Tables $4/6'. Reservation deadline Apr. 1st. VE Exams start at 9 AM for Novice to Extra. Send 610 form, copy of original license, or all current completion certificates, and check for $5.25 made payable to ARRL/VEC, to *Tom Shubitz, Box 157, Fergus Falls MN 56537.* First come first served walk-ins. Contact *Keith McKay NØFKF, RT 1 Box 46, Battle Lake MN 56515. (218) 826-6274.*

APR 13-14

ABILENE, TX The Key City ARC will sponsor the ARRL West Texas Section Convention & KCARC Hamfest at the Downtown Abilene Civic Center Sat. from 8 AM–5 PM, and Sun. from 9 AM–4 PM. Set-up 6 PM–10 PM Fri. There will be an easy Ham Breakfast at the headquarters motel from 6 AM–9 AM. Dial *1-800-588-0222* for room reservations at the Quality Inn. Tables $2, free electricity. VE Exams, walk-ins okay. Tickets $5 in advance, $6 at the door. Registration deadline is Apr. 11th. Make check payable to KCARC and send with SASE to *KCARC, PO Box 2722, Abilene TX 79604.* Contact *Bill Jones N5DOX, (915) 698-4606.*

APR 14

ROCKFORD, IL The Rockford ARA will sponsor the Rockford Amateur Radio/Computer Fair at the Forest Hills Lodge from 8 AM–3 PM. Free Parking. VE Exams. Wheelchair accessible. Tailgating. Tickets $3 in advance, $4 at the door. 8' table/2 chairs, $7 in advance, $10 at the door. Registration deadline is Apr. 1st. Send check and SASE to *Rockford ARA, 200 Westmoreland Ave., Rockford IL 61102.* Ticket/table/booth contact: *Al Gaines KA9VSZ, (815) 962-3910.* For info: *Joe Roling N9HEZ, (815) 399-6995.* Talk-in: 146.01/146.61 and 222.68/224.28 RARA repeaters.

FRAMINGHAM, MA The Framingham ARA Flea Market and Exams will be held at the North High School beginning at 10 AM. Admission is $2. Early bird admission at 9 AM, $5. Set-up 8 AM. 6' tables $12, paid in advance, includes one admission only. Code exams start at 11 AM, written exams given at 12:00. Send a completed FCC form 610, copy of current license, list of exams you plan to take and a check for $5.25, payable to ARRL/VEC to: *Dick Marshall WA1KUG, 37 Lyman Rd., Framingham MA 01701,* no later than Apr. 7th. Table contact: *Jon K1VVC, (508) 877-7166.* Exam info: *Dick WA1KUG, (508) 877-0563.*

RALEIGH, NC The Raleigh ARS RARSFEST '91 will be held from 8 AM–4 PM at the Jim Graham Bldg. of the NC State Fair Grounds. Free parking, RV's accommodated. Exams begin at 10 AM at the Holzhauser Bldg. Tickets $5 in advance, $6 at the door. Set-up at 12 noon Apr. 13th and from 6AM–8 AM Apr. 14th. Contact *Roland NF4P, 1421 Parks Village Rd., Zebulon NC 27597. (919) 269-4406.* For exams, contact *Vince AA4MY, (919) 847-8512.* Talk-in: 146.64/.04.

APR 20

BOWLING GREEN, KY The National Guard Armory will be the site of a Hamfest sponsored by the Kentucky Colonel's ARC. Doors open at 7:00. Contact *Denver Eadens N4WWA, (502) 777-3681,* or write to *K.C.A.R.C., PO Box 9781, Bowling Green KY 42102-9781.*

JOPLIN, MO The Joplin ARC will hold a Hamfest indoors at the National Guard Armory from 7 AM–3:30 PM. Tickets $2 in advance, $3 at the door. Tables $5. SASE/check to *Joplin ARC, c/o Larry Hendrix, 107 Hillview, Joplin MO 64804.* VE Exams, Fleamarket, Auction, 2M Rabbit Hunt. Talk-in: 147.21/147.81.

OTTAWA, ONT., CANADA The Ottawa Valley Mobile RC Inc. will sponsor a Flea Market from 0900–1600 EST at the Canterbury High School. Talk-in on 147.30/.90. Contact *Ken Barry VE3KJB, (613) 746-4823.*

APR 21

CLEVELAND, OH The North Coast ARC will hold their Spring Hamfest at the L.D.A. of Cuyahoga County, between 8 AM and 2 PM. Set-up at 6:30 AM. 8' tables $10 for the first, $8 each additional. For info, SASE to *Ron Nichols N8LZA, 5402 Velma Ave., Parma OH 44129. (216) 351-7787* after 6 PM.

SULLIVAN, IL The 28th annual Sullivan Hamfest, sponsored by the Moultrie AR Klub, will be indoors in four big barns. License Exams will be given from 9 AM–12 noon. Walk-ins accepted. A limited number of tables are available by reservation for $7.50 each. Tickets are $2 each or $5/3 in advance; $3 or $5/2 at the door. There is no set-up charge for the Flea Market. Contact *Ralph Zancha WC9V, 502 E. State St., Lovington IL 61937,* or call *(217) 873-5287 evenings.*

WELLESLEY, MA The Wellesley ARS will sponsor an Event at the Wellesley Sr. High School parking lot from 9 AM–2 PM. Handicap accessible. Admission $2. Talk-in: 147.03/.63 Wellesley repeater. Contact *Gerry Driscoll NV1T, (617) 444-2686.*

APR 25-28

DAYTON, OH The Dayton AR Assn., Inc. will sponsor the Annual Dayton HamVention at the Hara Arena Conference and Exhibition Center. Flea Market set-up will begin at 0800 Thurs., Apr. 25th. Flea Market operating times are: 0800–1800 Fri., Apr. 26th; 0600–1700 Sat., Apr. 27th; 0600–1600 Sun., Apr. 28th. Contact: *Flea Market Committee, (513) 767-1107.*

APR 26

DAYTON, OH The Dayton/Cincinnati Chapter of the Quarter Century Wireless Assn. will host the 1991 annual QCWA Banquet at Neil's Heritage. C.O.D. bar at 6:30 PM. Banquet starts at 7:30 PM EDT. Tickets $15 each, reservations required. QCWA membership not required. Contact *Bob Dingle KA4LAU, 657 Dell Ridge Dr., Dayton OH 45429. (513) 299-7114.*

SPECIAL EVENT STATIONS

VERMONT Throughout the coming year, Special Event Stations from Vermont will be on the air to help Vermont celebrate its 200th birthday. A special 200th Anniversary Certificate is available. SE Stations will be operating 25 kHz up from the bottom of the Novice and General bands. RTTY/AMTOR/etc. will be in the digital sub-bands. For certificate, send $1 and a SASE to *Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.* Foreign stations, send only SAE and IRC's to cover postage.

APR 15

FORT PIERCE, FL The Fort Pierce ARC will operate KJ4YF from 1400Z–2100Z to commemorate the 4th Annual Trail Ride of the Florida Cracker Trail Assn. Operation will be on the 40, 20, 15, and 10 meter phone bands, and the Novice portion of 10 meters. For certificate, send QSL and large SASE to *FPARC, PO Box 0004, Fort Pierce FL 34954.*

APR 21

DELAWARE Never ones to learn from past mistakes, the members of the Warminster ARC will conduct their third annual DXPedition to the rare state of Delaware, operating WA3DFU/3. Frequencies: 7.275, 14.275, 21.375 and 28.375 MHz. CW contacts will be made on request. QSL with SASE to *Warminster A.R.C., Box 113, Warminster PA 18974.*

ST. LOUIS, MO The Suburban ARC will operate WØDCW, from 1800–2400 UTC, to celebrate the 44th Anniversary of the Club. Operation will be on the lower portion of the General Bands and 28.425 MHz (Novice 10 meter). Please send SASE for a QSL card to *Henry G. Schaper, Sr. KAØAWS, 241 Tapestry Dr., St. Louis MO 63129.*

APR 20-26

MADISON, WI The West High School ARC will operate Station KB9NG from 1300Z–2200Z, to commemorate West High School's Fine Arts Week. Frequencies: Lower 30 kHz of the General 20 meter and 15 meter phone bands and 10 meter Novice phone band. QSL, SASE to *WHARC, 30 Ash St., Madison WI 53705.*

APR 25-28

PADUCAH, KY The Paducah ARA will operate W4NJA to celebrate the annual American Quilters Society Convention. Frequencies—CW: 7.125, 14.050, and 21.150 MHz; phone: 3.875, 7.250, 14.250, 21.375, and 28.450 MHz; packet: 145.010. For QSL, send QSL and large SASE to *Paul Smith N4FFO, 229 Nickell Hts. Rd., Paducah KY 42003.*

APR 27

THOMASVILLE, GA The Thomasville, Georgia ARC will operate W4UCJ from 1830Z Apr. 26th until 0200Z Apr. 27th, and 1530Z–2300Z Apr. 27th, to celebrate the 70th annual Rose Festival. Frequencies: Lower CW portion of the General bands and Novice SSB portion of 10 meters. For a certificate, please send QSL and SASE to *Thomasville ARC, PO Box 251, Thomasville GA 31799-0251.*

POUGHKEEPSIE, NY The Poughkeepsie RAC will operate Station K2KN from the Young/Morse Nat'l Historic Landmark on the Hudson River from 1400 UTC–2000 UTC, to celebrate the 200th birthday of Samuel F.B. Morse. Frequencies—CB: 3.710, 7.110, 14.050, 21.110, 28.110 MHz ±10 kHz. SSB: 3.90, 7.235, 14.235, 21.335, 28.40 MHz ±10 kHz. DX QSL cards responded to via the ARRL DX Bureau. USA QSL cards answered when receiving SASE, and if a special certificate is desired, a 9"x12" SASE. Send to *Ted Zulkowski K2JMY, 4 Bishop Dr., Poughkeepsie NY 12603.*

INTERNATIONAL MARCONI DAY This year's event will be celebrated from 0000Z–2400Z. There will be about 15 stations representing Marconi communication sites around the world. North American sites are VE1IMD, VO1IMD and K1VV/IMD. Most site stations will use the suffix "IMD" or "/IMD." A certificate (modeled after an actual Marconi stock certificate) is offered to those who work the most Marconi sites (the number will be announced on the air). More award details will be given by site stations. All modes may be used this year; CW, RTTY, SSB and packet. The event is coordinated by the *Cornish RAC, PO Box 100, Truro TR1 1RX, Cornwall, England.*

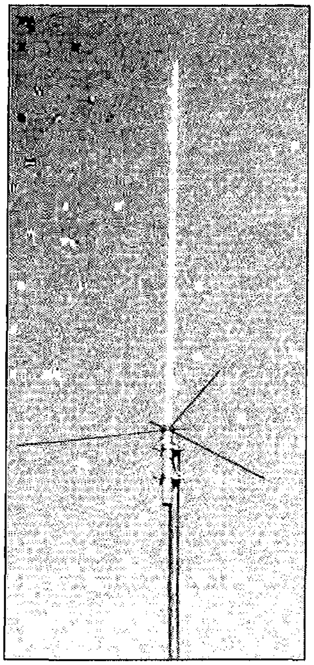
APR 27-28

U.S.S. OLYMPIA The Olympia ARC will operate Station WA3BAT from aboard the U.S.S. Olympia, from 1300 UTC Apr. 27th–2000 UTC Apr. 28th, to commemorate the 92nd Anniversary of Admiral Dewey's triumph over the Spanish Fleet at the Battle of Manila Bay during the Spanish-American War. Frequencies—CW: 7.133 MHz; RTTY: 40, 20, 15 meter bands; 2 meter FM: 145.270; phone: 3.895, 7.245, 14.245, 21.365 and 28.365 MHz (±5 kHz QRM). For certificate, send QSL and 9" X 12" SASE with three units of postage/IRC's to *Olympia RAC WA3BAT, PO Box 928, Philadelphia PA 19105.*

NEW PRODUCTS

Compiled by Hope Currier

PRODUCT OF THE MONTH

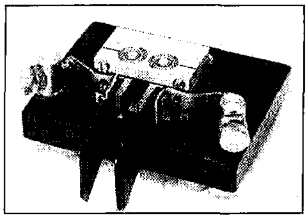


NCG Model CX-908

The Model CX-908 from NCG/COMET Antenna is the world's first triband base antenna for 144, 430 and 900 MHz. This one-piece, Fiberglas™ antenna will withstand wind velocities of 134 MPH, and is completely water/pollution-proof. It is extremely wideband, so it doesn't require frequency adjustment. Its lightning protection guards your transceivers. Using the CX-908 with a COMET triplexer (CFX-431, CFX-4310) will allow three-band TX/RX communications at the same time.

For prices and more information, contact *NCG Co., 1275 North Grove St., Anaheim CA 92806; (714) 630-4541; FAX (714) 630-7024.* Or Circle Reader Service No. 201.

Palomar Engineers



Many top CW operators consider the Kent key to be the world's best. The design and machining of the precision brass mechanism is by R. A. Kent Engineers in England; the key is assembled at Palomar Engineers in the United States. It features rotary ball bearings, fully-enclosed springs, and individual knurled thumbscrews to adjust dot and dash contact spacing and spring tension. The key has a smooth, effortless action because it has rounded paddles that are easy on the fingers. The small footprint (3" x 4") steel base weighs over two pounds.

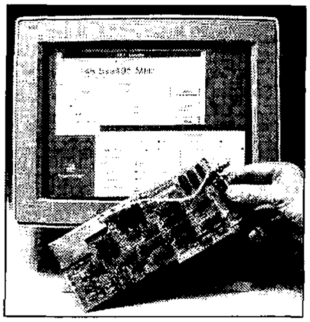
The price is $100, plus $4 shipping for the United States and Canada. Contact *Palomar Engineers, P.O. Box 455, Escondido CA 92033; (619) 747-3343, FAX (619) 747-3346.* Or circle Reader Service No. 203.

JDR Microdevices

JDR Microdevices has just released a new "Power Up" catalog, filled with products to help computer enthusiasts maximize the speed and efficiency of their equipment. The new products include JDR's own FrontPanel, a bus extender and instruction execution detector in one, perfect for hardware and software debugging; and JDR's Breadboard-on-a-Card Series, with decode, for faster, easier prototyping. Other new items include an accelerator card for A2000 with a high speed 28 MHz 68030 CPU, a modular circuit technology 486 motherboard, Amiga products, and an expanded software line with numerous software products for Windows.

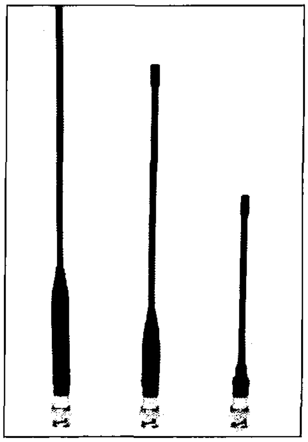
For a copy of the catalog, contact *JDR Microdevices, 2233 Branham Lane, San Jose CA 95124; (408) 559-1200, FAX (408) 559-0250.* Or circle Reader Service No. 204.

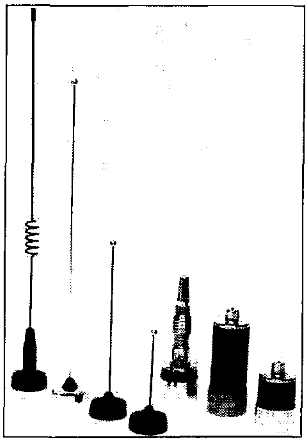
Optoelectronics



Optoelectronics has announced a radically new type of universal frequency counter-timer: a 9-inch drop-in card for personal and laptop computers. It uses Windows 3.0 as a control panel and display window, and it directly tunes radio receivers such as the ICOM R7000, resulting in a uniquely-configured self-tuning radio. The Model PC-10 is a 10 Hz–2.4 GHz radio instrument that competes with more expensive big name products. It measures, captures and analyzes discrete and average frequency readings, pulse width, time interval, period, and the ratio between two frequencies. It provides a useful "reciprocal counting" feature for 8-digit resolution of low frequency readings.

The Model PC-10 is priced at $335 in unit quantities. The Model AP10H option ($295) provides custom input amplifiers, signal conditioning and frequency prescalers. Contact *Optoelectronics Inc., 5821 NE 14th Avenue, Fort Lauderdale FL 33334; (800) 327-5912, (305) 771-2050, FAX (305) 771-2052.* Or circle Reader Service No. 205.





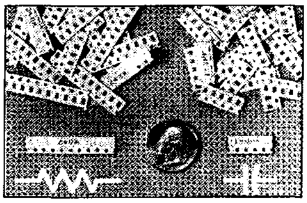
Valor Enterprises

Valor Enterprises has introduced a new line of rubber ducks (above left) available for 140, 220 and 440 MHz. These new portable antennas feature a BNC connector and a long-lasting vinyl dip coating for years of reliable service.

Valor, a longtime leader in the manufacturing of cellular and CB antennas, is also offering the new Omni-Gain line of land mobile antennas (above right) in all frequency ranges, including 900 MHz. A wide variety of mounting hardware is available.

For prices and more information, contact *Valor Enterprises, Inc., 185 West Hamilton Street, West Milton OH 45383; (513) 698-4194, (800) 543-2197, FAX (513) 698-7273.* Or circle Reader Service No. 202.

Communications Specialists



Communications Specialists, Inc. is now offering surface mount resistors and capacitors in small quantities and in individual values. The unit of sale is "per strip," and there is a $10 minimum requirement per order. Resistors come in strips of 10 for $2.50 per strip; capacitors come in strips of five for $1.25 per strip. Each strip is clearly marked with the value.

Contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800) 854-0547, (714) 998-3021, FAX (714) 974-3420.* Or circle Reader Service No. 206.

Number 20 on your Feedback card

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Donna DiRusso, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

BATTERY PACK REBUILDING: SEND YOUR PACK / 48HR SERVICE ICOM: BP2/BP3/BP22 $19.95. BP5/BP8/BP23 $25.95. BP24/BP70 $26.95. BP7 $32.95. KENWOOD PB21 $15.95. PB21H/PB6 $22.95. PB25/26 $24.95. PB2/PB8 $29.95. YAESU: FNB9 $19.95. FNB10/17 $23.95. FNB11 $29.95. FNB3/4/4A $36.95; STS: AV7600 $27.95. ZENITH/TANDY LT PACKS $54.95 "U-DO-IT INSERTS" ICOM: BP3/BP22 $16.95. BP5/8/24/70 $21.95. KENWD: PB21 $12.95. PB21H $18.95. PB24/25/26 $19.95; TEMPO/S $22.95. YAESU: FNB9 $16.95. FNB10/17 $18.95. FNB4/4A $32.95. AZDEN: $19.95. "NEW PACKS": ICOM BP8B (BS CHG) $34.95. SANTEC: 142/1200 $22.95. YAESU: FNB2/500 $19.95. FNB2/600 $23.95. FNB17 $34.95. FREE CATALOG. $3.00 Shipping/order. PA + 6%. VISA-MC + $2.00. CUNARD, R.D.6 Box 104, Bedford PA 15522. (814) 623-7000. BNB258

CHASSIS, CABINET KITS SASE, K3IWIC, 5120 Harmony Grove Rd., Dover PA 17315 BNB259

DESK PAD DXCC country list and scratch pad all-in-one. Maximize contact time and desk space. 11" x 17". Hams in Seattle love it! Now available nationwide, 2 for $7.00 postage paid in USA. Free QSL note pad with order. Radio Stationery, 13212 E. 41st Terr., Independence MO 64055. BNB262

AMATEUR RADIO CLASSIFIED Quality equipment Buy/Sell/Trade publication. Published twice monthly. Samples free. Ads: 25 cents/word. Subscriptions: $12/yr. POB 245-S, Jonesboro GA 30237. BNB263

HAM RADIO KITS & ASSEMBLIES for various *QST* & *73* construction articles. We also offer books and electronic components. For catalog, send legal size SASE w/45¢ postage or $1.00 to A&A Engineering, 2521 W. La Palma #K. Anaheim CA 92801. BNB264

PERSONAL COMPUTER INTERFACING Practical instrument automation, networking and control techniques, including microcontrollers. A 3-day, hands-on workshop at the Virginia Tech campus, Washington, D.C., and Charlotte NC $595. Blacksburg VA, March 21-22-23; Washington, D.C., June 6-7-8; Charlotte NC, July 18-19-20; and Blacksburg VA, August 22-23-24. Dr. Roy Jones (703) 231-5242/231-6478 BNB265

BLIND, BEDRIDDEN VETERAN would like friends to help by donating any shortwave or amateur radio receiver. Call Richard at 213-938-5347. Welcome letters. Write to: 5909 W. 6th St., Los Angeles CA 90036 BNB266

QSL CARDS- Look good with top quality printing. Choose standard designs or fully customized cards. Better cards mean more returns to you. Free brochure, samples. Stamps appreciated. Chester QSLs, Dept A, 310 Commercial, Emporia KS 66801, or FAX request to (316) 342-4705. BNB434

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. $10. LEARN MORSE CODE IN 1 HOUR. Amazing new supereasy technique. $10. Both $17. Moneyback guarantee. Free catalog: SASE. Bahr, Dept 73-10, 7320 Normandy, Cedar Rapids IA 52402. BNB531

SB-220/221 OWNERS: 20 detailed mods which include 160–6 meter operation, QSK, +enhanced p.s. 50% rebate for new mods submitted! 9 pages of 3-500Z tech info. $11 postpaid.—Info. SASE, BOB KOZLAREK WA2SOQ, 69 Memorial Place, Elmwood Park NJ 07407. BNB581

ROSS' $$$$ USED April SPECIALS: KENWOOD TS-830S $789.90, TR-7800 $249.90, TS-930S/WAT $1199.90, BC-11 $69.90, BC-10 $35.90, TM-521A $429.90, TV-506 $209.90; ICOM IC-AH2A $349.90, AT-500 $249.90, R-71A+FLTERS $799.90, PS-15 $122.90; YAESU FC-757AT $259.90, FT-102 $569.90, DC-200 $59.90; KAYPRO 16 10 MEG HARD DISK $500.00, 2861 20 MEG HARD DISK $700.00, KAYPRO 10 10 MEG HARD DISK $400.00. LOOKING FOR SOMETHING NOT LISTED?? CALL OR SEND S.A.S.E., HAVE OVER 185 USED ITEMS in stock. MENTION AD. PRICES CASH, FOB PRESTON. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB654

WRITTEN EXAMS SUPEREASY. Memory aids from psychologist/engineer cut studytime 50%. Novice, Tech, Gen: $7 each. Advanced, Extra: $12 each. Moneyback guarantee. Bahr, Dept 73-10, 7320 Normandy, Cedar Rapids IA 52402. BNB691

ROSS' $$$$ NEW April (ONLY) SPECIALS: J.S.C. RG-213 500FT. $150.00; ELITE 33 FT.MOTOR HOME, LIST $100,000.00, NET $50,000.00 (DEMO); KENWOOD TH-26AT $259.90, R-5000 $849.00, TH-77A $500.00, TM-241A $324.90, TS-440SWAT $1209.90, TS-850SWAT $1609.90, TS-811A $1260.90; ICOM IC-735 $919.90, IC-761 $2200.00, IC-725 $765.90, IC-471A $709.90, IC-2SA $279.90, IC-24AT $459.90, IC-O3AT $385.00; AMERITRON AL-1200 $1699.90, AL-80A $979.90, AL-811 $534.90, AL-82 $1699.90; ASTRON RS-12A $68.95, RS-20A $87.90, RS-35A $139.90; ALINCO DJ-560T $379.90, DJ-160T $244.90, DR-570T $495.90, DR-110T $285.00, DR-590T $560.00; BUTTERNUT HF6V-X $144.90, STR-II $35.90. SEND S.A.S.E. FOR USED LIST. ALL L.T.O. (LIMITED TIME OFFER) LOOKING FOR SOMETHING NOT LISTED?? CALL OR WRITE. Over 9039 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. PRESTON. HOURS TUESDAY-FRIDAY 9:00 TO 6:00. 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB709

HAM RADIO REPAIR all makes, models. Experienced, reliable service. Robert Hall Electronics, Box 280363, San Francisco CA 94128-0363. (408) 729-8200. BNB751

WANTED: Ham equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. As 1991 begins, please look over whatever unwanted equipment you may have, and call us. We will pick up or arrange shipping. You will receive the tax deduction, but most important, the privilege of knowing that your gift really made a difference in the education and upbringing of a child. Meet us on the WB2JKJ CLASSROOM NET, 1200 UTC ON 7.238 MHz, and hope to see you at Dayton. Write us at: The RC of JHS 22 NYC, Inc., PO Box 1052, New York NY 10002. Round the clock HOTLINES: VOICE (516) 674-4072, FAX (516) 674-9600. BNB762

"HAMLOG" COMPUTER PROGRAM Full features. 18 modules. Auto-logs, 7-band WAS/DXCC. Apple, IBM, CP/M, KAYPRO, TANDY, CR8 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

LAMBDA AMATEUR RADIO CLUB International amateur radio club for gay and lesbian hams. On-air skeds, monthly newsletter, and annual gathering at Dayton. (215) 978-LARC. PO Box 24810, Philadelphia PA 19130. BNB812

INEXPENSIVE HAM RADIO EQUIPMENT. Send postage stamp for list. Jim Brady—WA4DSO, 3037 Audrey Dr., Gastonia NC 28054. BNB890

WANTED: BUY & SELL All types of Electron Tubes. Call toll free 1 (800) 421-9397 or 1 (612) 429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB900

ELECTRON TUBES: All types & sizes. Transmitting, receiving, microwave . . . Large inventory = same day shipping. Ask about our 3-500Z special. Daily Electronics, PO Box 5029, Compton CA 90224. (800) 346-6667. BNB913

COMMODORE 64 HAM PROGRAMS—8 disk sides over 200 Ham programs $16.95. 25¢ stamp gets unusual software catalog of Utilities, Games, Adult and British Disks. Home-Spun Software, Box 1064-BB, Estero FL 33928. BNB917

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WANTED: For museum and author—pre-1980 microcomputers and publications—also need CPM computers, Osborne, Kaypro, etc. Need author to write detailed book on how to use the PACKRATT software. Dave Larsen KK4WW, Blacksburg Group, PO Box 1, Blacksburg VA 24063-0001. (703) 763-3311/231-6478. BNB945

JUST IMAGINE your own beautiful Blue Ridge mountain top QTH—selling my 323-acre Christmas tree farm—all or part—trees optional. KK4WW, Floyd VA. (703) 763-3311. BNB956

CUSHCRAFT, Barker & Williamson, power supplies, rotors, baluns, center insulators, ladder line, coax, connectors, surplus tubes. ATKINSON & SMITH, 17 Lewis St., Eatontown NJ 07724. 1 (800) 542-2447. BNB957

2600/2510 OWNERS Enjoy both 10 meters *and* 12! Easy conversion, all parts and instructions, $49.95. Edward Oros, 2629 Sapling Drive, Allison Park PA 15101. BNB958

FREE Ham Gospel Tracts, SASE, N3FTT, 5133 Gramercy, Clifton Hts. PA 19018. BNB960

FIVE WATTS! ORP "E-Z-KITS!" With complete instructions! Specify 30 or 40 meter model. Only $15 plus $2.50 First Class shipping! Bill Lauterbach, 1709 N. West, #103, Jackson MI 49202. BNB962

PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook*. List SASE. FAR Circuits, 18N640 Field Ct., Dundee IL 60118. BNB966

SATELLITE MONTHLY AUDIO CODES 1 (900) HOT-SHOT. Intended for testing only. $3.50 per call. BNB976

AMIGA, MACINTOSH, ATARI XL/XE/ST Amateur radio and electronics PD software, $4.00/disk. Send 2 stamps SASE for catalog. Specify which computer! WA4EFH, Box 1646, Orange Park FL 32067-1646. BNB978

AZDEN SERVICE by former factory technician. NiCads $36.95 plus shipping. Southern Technologies Amateur Radio, Inc., 10715 SW 190 St. #9, Miami FL 33157. (305) 238-3327. BNB979

DIGITAL AUTOMATIC DISPLAYS Kenwood, Yaesu, Collins, Drake, Atlas, etc. No bandswitching required. Business 45¢ S.A.S.E. Be specific. GRAND SYSTEMS, Dept. A, PO Box 3377, Blaine WA 98230. BNB981

NOW YOU CAN OWN THE ULTIMATE JRC-JST 135 or JST 135 HP HF transceiver. Also the general coverage HF receiver JRC-NRD 525 or NRD 535. Our special prices: JST-135, $1749.00; JST-135 HP $2949.00; NRD-525 $1049; and NRD-535 TBA. Call Henry, N4EDO, AMATEUR RADIO SALES, 1 (800) 828-6433. Also let us be your accessories and complete radio store. BNB982

TRAVEL! HIGH INCOME! Radio officers needed for shipboard employment. Must have FCC Second Class Radiotelegraph license and background in electronics. Salary approximately $4,000 monthly to start, including vacation plus full benefits. Rae Echols, W7FFF, American Radio Association, 5700 Hammonds Ferry Road, Linthicum Heights MD 21090. BNB983

HW-8 HANDBOOK. It's back and bigger than ever. Modifications for the Heath HW series of ORP radios, including the new HW-9. $7.95 for US and VE, including first class postage. $12.95 for DX. Send to Michael Bryce, WB8VGE, 2225 Mayflower NW, Massillon OH 44647. BNB984

REPOSSESSED VA & HUD HOMES available from government from $1 without credit check. You repair. Also S&L bailout properties. Call 1-805-682-7555 ext. H-4470 for repo list your area. BNB985

SEIZED CARS, trucks, boats, 4wheelers, motorhomes, by FBI, IRS, DEA. Available your area now. Call 1-805-682-7555 ext. C-3968. BNB986

TEST EQUIPMENT WINTER CLEANOUT SALE. Many good, lab grade items at lowest prices, must be sold. HP-140T spectrum analyzer, Tektronix portable scopes 453, 475, HP-606A Sig/gen, 5245L counters, 500 MHz, 3-GHz, GR, Boonton bridges, DVMs, much more. Can't list all here—please SASE for huge list. Joseph Cohen, 200 Woodside, Winthrop MA 02152. (617) 846-6312. BNB987

XEROX DESKTOP COMPUTER. CPM. WP/SS/BASIC software, manuals. Transcriber, Heath HW-7, SB101. Other computer, photographic, ham stuff. TRADE for 2 meter rig, frequency counter, etc. Dean, POB 10382, Eugene OR 97440. (503) 683-2985. BNB988

BACK BY POPULAR DEMAND: W1FC Collins design vertical phase switching. **REVOLUTIONARY HYBRID AERIAL PRODUCT:** 168 strand copper "FLEX-WEAVE" Tm, #14, strong, ultra flexible, nonstretch, won't rust/kink like copper weld, $34 first 275' (minimum), $.12/ft thereafter, includes shipping! **"Updated" ANTENNA PARTS CATALOG, LOWEST PRICES:** Dipole/quad/GROUND RADIAL WIRE, insulators, baluns, center feeds, OPEN WIRE FEED LINE, premium coaxes, lowest cost RG-213 mil spec $.39/ft. RG-8X $.20; HV & specialty wire. Catalog: $1.00. DAVIS RF, PO BOX 230-S, Carlisle MA 01741. (508) 369-1738. BNB989

GROUND RADIAL WIRE FOR VERTICALS OR SLOPERS: Improves performance, new #16 bare solid copper. LOWEST COST: $38 1000 feet, includes shipping! STATION GROUNDING SYSTEMS, a must for family/equipment safety. "Updated" Catalog of specialty wire, coax, VERTICAL PHASE SWITCHES (W1FC), antenna parts, lowest costs: $1.00 DAVIS RF, PO BOX 230-S, Carlisle MA 01741. (508) 369-1738. BNB990

Number 21 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

User Rights, Revisited

Since I began writing this column back in 1972, the single question that I have been most often asked to address is that of the rights of repeater users in determining the overall operating standards of a given system. I'm not just referring to the technical aspects of system operation, I'm thinking in terms of every aspect: technical, social and legal.

Where I live, repeaters come in three categories: open machines, closed machines and private machines. Actually, if you add the so-called "super private" and the "pirate/uncoordinated" systems, there are really five very different operational categories. Thankfully, the rest of the nation is not as title-conscious as Southern California. Almost everywhere else, all you find are open and closed coordinated boxes and a smattering of the "uncoordinated" pirates.

In my travels nationwide, I have noticed one amazing thing: Whether a repeater is open or closed, it usually falls under one distinct form of internal operation. Either it is a club repeater whose operation is governed by a repeater trustee elected by the membership, or it is an individually owned and operated system, run by what has become known as a "benevolent dictator." In either case, the outcome is the same. An individual or a small group determines what all others who pass their audio through a repeater can or cannot say. There is a monarchy, so to speak, where there are essentially "gods" in the form of repeater owners, and "peasants" in the guise of a repeater's usership. This is the basic and tenuous relationship that really has been around since the days of the old AM repeaters in the late '40s, and out of it has grown the vast repeater network that spans the length and breadth of the United States, as well as its neighbors to the north and south.

At this point, it is probably fair to say that if the system works, why change it? I think you can answer this question by asking, "Why change apartheid?" If you think about it, what is going on in South Africa and on the VHF/UHF repeater subbands is really the same in essence—a small minority lording over a vast majority. Be it for racial reasons or ego fulfillment, playing God over others is just not tolerated in this society or age.

The truth is that the system has not really worked. Oh, I'll admit that it is staggering to have almost 10,000 repeaters on 2 meters in the United States. According to listings in the *ARRL Repeater Directory*, that is. The number approaches 15,000 when you take all other bands into account. And that is not even considering the thousands of remote bases that sit atop mountains and tall buildings, giving a single individual with a handheld total access to all modes on all bands. So, on the surface, there is a look of success.

But when you listen closely, you find that there are a lot of very unhappy people out there. These are people who, by virtue of the fact that they have invested money in a handheld, a mobile, and a base radio installation, feel that it is their God-given right to also demand a say in the way every aspect of every repeater they use is to be run. In the '70s, these people were openly called "fanatics" by their peers. In the '80s, their call began to get some valid attention as their numbers began to grow. Now, with the end of the first year of the 1990s, the concept of user rights has surfaced again, and this time it has the backing and support of a wide segment of the population of Southern California.

In fact, like it or not—and that depends on whether you are a repeater owner or a repeater user—the demand for so-called "user rights" is now the hottest topic in this part of the country, and as word of the coordination board action of October 6, 1990, begins to reverberate across the nation, it is sealing the fate of repeater "gods" everywhere. It is saying to repeater owners—be they clubs or individuals—that the day of total owner control is at an end. It has now ended in my part of the world, and you can be pretty certain that it will eventually end in yours. It ended because a repeater coordination council has said to the world that the wants, wishes and desires of repeater users take precedence over anything that a system owner may want or demand. TASMA has said that users do have rights!

The TASMA Meeting

TASMA, Southern California's Two Meter Area Spectrum Management Association, is the 2 meter by-band coordinator for all activity across the state, and south from the Tehachapi mountain range down to the Mexican border. The other two are SCRRBA, the Southern California Repeater Remote Base Association, taking care of 6 meters and all UHF/Microwave coordination; and the 220-SMA which, as its name implies, coordinates 220 MHz. But, unlike repeater councils, both TASMA and 220-SMA are chartered as overall spectrum management groups. In other words, repeater coordination is only supposed to be a tiny part of all-around band management. All three groups can trace their lineage to the original California Amateur Relay Council, the nation's first coordination body in the late '50s.

As such, TASMA is hardly a Johnny-come-lately to the arena of settling disputes between repeaters, but until now, even it has shied away from tackling a repeater-user versus repeater-owner fray. But when it broke away from the now-defunct Southern California Repeater Association in 1979, it also widened its sphere of influence to include every signal that would ever be put onto 2 meters in the region, and its bylaws gave the promise of equal representation before the membership to any individual or group that requested it. So, TASMA agreed to listen to the complaints of a group of users who claimed that the owner of the repeater they used was literally pulling the rug out from under them. They claimed that the owner, Dave Witt KE6HN, was using the repeater to punish them because he did not like the way that they operated. He did this by locking out the repeat function and playing Gordon West Radio School CW training tapes—music and all—whenever he or his control operators did not like what was being said.

The user group bringing the matter to TASMA was from the 147.435 machine, a high-tempered system that has gone through more than a half-dozen owners since its inception over two decades ago, starting out as WA6TDD in the late 1960s. The .435 system, whose callsign when this story began was KE6HN/R, sees and talks to much of the southern portion of the state, with coverage into northern Baja California, Mexico. Even on its odd-split frequency pair of 147.435 in/146.40 MHz out, it was one of the nation's most populous repeaters, with a user base in the late '70s nearing 700. But numbers brought problems. Unlicensed operators, jammers, and a smattering of foulmouths worked their way into the daily regimen of .435 operation. The situation kept getting worse and worse, and the system owner wanted to clean it up, but the users of .435 wanted a free and open forum for discussion of any and all subject matter. They wanted no prohibitions on language, and said that each would take legal responsibility for what he or she said on the air. This conflicted with recent interpretations of the Part 97 rules which place shared responsibility for content of repeated communications on the originating station and the licensee of the relay operation. This notwithstanding, the usership demand was for minimal control by the system owner, Dave Witt KE6HN.

The Winds of Change

In mid-1990, KE6HN petitioned TASMA to permit him to close and make private the long-established open .435 machine. Reportedly, this was to be a part of the way in which he would change the atmosphere on .435 and clean out the "rat's nest." TASMA told Witt that the frequency pair was reserved for an open operation system, and that he must continue operation in that category. (In Southern California, once a system's operational format has been established, no changes can be made without the approval of the coordination council.)

Witt was also told by TASMA that the code practice tapes that he was running to censor user comments and counter what he felt to be abusive user behavior must be stopped. While the precedent of using code practice tapes to control user abuse was established in the 1970s on the old K6MYK repeater, not until now has this system owner practice been challenged by users before a coordination body.

TASMA Acts

Based on audiotapes provided, and a petition from the users written by Professor Roy Tucker N6TK and circulated by Jensen Woods WB6ZFU, TASMA's membership voted to issue a "Show Cause" order to KE6HN, giving him until the next TASMA meeting (approximately 30 days) to show the coordination organization why he should not lose his right to operate the repeater bearing his callsign. He was also admonished in absentia for changing the repeater callsign to one of another ham, and TASMA has indicated that it will not recognize such a change because its coordination guidelines call for pre-approval of any such operational modification.

In issuing its decision against Witt, the TASMA Board of Directors made it clear that the repeater's user base, and the system owner adhering to the long established use of the channel for open operation, were their prime interests. They also indicated that repeater users have a right to expect that repeaters will always be run as the channel pair sanction stipulates—a stand that many coordinators have held privately, but never before shown so forcefully in public.

TASMA then stripped Witt of his sanction to operate the .435 repeater and recoordinated the frequency pair to Jensen Woods WB6ZFU. Witt was given a chance to file an appeal, which he did. But before the appeal could be heard, Witt surprised everyone by selling off the repeater hardware to Roy Tucker N6TK and Woods, thus codifying the TASMA decision as a "de facto" coordination regulation for the region. As we go to press, Woods is doing everything humanly possible to rid .435 of its jammers, foulmouths, carrier-throwers, unlicensed operators—and its bad reputation in the area. At this writing, what he has undertaken seems to be an almost superhuman task, and we wish him well. Will WB6ZFU succeed where many others have failed? Only time will tell.

A Public Utility?

There is a caveat to this change. In effect, TASMA has unintentionally codified what many hams have felt for the better part of two decades. That is, repeaters are now not as much ham radio stations as "amateur radio public utilities." They, along with the newer packet digipeaters, are the de facto "telephone and telegraph relay stations" of the world of amateur radio. Hams expect repeaters to be there, 24 hours a

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day, seven days a week, 52 weeks a year, at the beck and call of anyone with a ham ticket and the money to purchase a transceiver of his own. Therefore, the TASMA decision regarding .435 in Los Angeles will impact on all of the nation's repeaters and repeater owners in ways never dreamed of before.

Like it or not, TASMA's decision concerning .435 means that organized user groups can now place demands on repeater operators, and those owners will be forced to comply with their whims or be run off the air by someone who will comply. On the negative side, it could mean that a budding system owner who can't find a spot for his new machine might "raid" another repeater's user base for support. On a more positive note, since the user group's voice will be heard as well as the repeater owner's voice, the owner will be able to more actively challenge co-channel and adjacent channel systems to abate any interference. The greatest impact of all may be that of making "closed" and "private" repeaters vulnerable to decoordination in favor of high volume user-load open systems.

If you think that none of this will ever take place, you know little about human nature, and even less about the crowded repeater subbands. I'll bet that it actually begins to happen long before this reaches print. In our litigatory society, it will also only be a matter of time before TASMA's decision to favor user groups over repeater owners leads to court challenges to other repeater coordinators who fail to consider user complaints. It will also most assuredly lead to litigation between user groups and system owners, and vice versa. Then again, no decision made by man is perfect, and TASMA, like all other repeater coordination groups, is made up of human beings.

Hindsight is Wonderful

Ten years ago, in this same column, I predicted that it wouldn't be long before user rights became the most important issue to surface in the world of VHF/UHF relay communications. I was off by about half a decade, but not wrong on seeing the problem. Now it is here, and with it the distinct possibility that tens of thousands of potential repeater owners and users will come to the hobby with no-code Technician class tickets, and the right to put up repeaters of their own.

How do the repeater coordinators and repeater owners of today see themselves? The users—hams like you—are demanding a full measure in determining the way a repeater—all repeaters—will be run. The owners and coordinators may have no alternative but to listen and act on your desires, or take their repeaters off the air forever. As Bob Dylan sings, "...the times they are a changin.'"

Special thanks to Rich Yarigian N6PVP for attending the TASMA meetings and researching much of this story. ■

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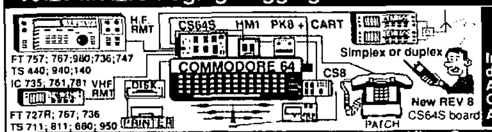

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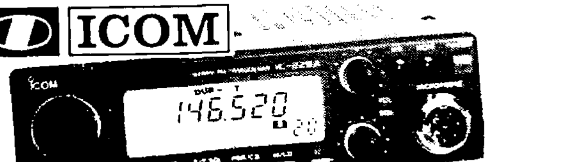

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No Fooling

I hate April Fool's Day. I really do! Somehow, there is nothing so low as tricking someone into believing some untruth or fantasy. Unfortunately, so many hams become such fools when they purchase this or that RTTY communications program. This month, I'd like to tell you about a program that won't "fool" you or take you to the poorhouse with cost.

After several editions, Skyline Associates' TRTY.EXE program has matured into one that rivals commercial offerings. Originating in the Heath Computer Radio Net, this program, authored by T.L. Vinson and coauthored by all the participants of the net, features a dual port and split screen radioteletype interface that allows full computer control of a RTTY station.

The TRTY.EXE Program

Highlighted features of TRTY.EXE version 3001.00 include:

•Support for two serial ports simultaneously, in half or full duplex.

•Ability to run AMTOR, packet, or RTTY communication, in any combination of two modes.

•Support for Baudot and 7 or 8 bit ASCII, with baud rates of 45 to 9600.

•Software and hardware handshaking.

•User-selectable screen colors, text, background, window edges and borders.

•Configuration of files, recalled by name.

•Ability to assign different callsigns to each port.

•Option to set the program to BEEP when it recognizes your callsign.

•Full-screen editing.

•Scrolling option, through previously shown text.

•Ability to edit text in one window, while monitoring one or both ports in other windows.

•Compatibility with IBM PCs, clones, and the Zenith Z-100, with 300K RAM, and MS DOS or PC DOS versions 2.0 or higher.

When the program is booted, the logo screen, shown in the figure, is displayed. If this bothers you, it can be switched off. The split screen display is where the bulk of communicating is performed. Hitting the F1 key brings up the HELP menu. This menu leads to a variety of submenus for both help and editing program features.

A look at some of the specifics of this program makes you realize what a finely honed tool it is. For example, TRTY supports 3rd and 4th level Baudot. This is a programming technique in which the full ASCII character set is represented in 5-bit Baudot, by using Blank-FIGS or Blank-LTRS combinations to indicate a shifted set. Received on a conventional teleprinter, normal Baudot is printed; received on another TRTY station, upper and lower case data can be exchanged.

There is also a RELAY mode, which allows remote stations access to relay messages through your station, without operator intervention. In this mode, a timer prevents messages from staying too long in the program's buffer, and ensures practical use of the feature.

Full keyboard remapping is also supported. This means, on one level, that any command normally assigned to a control key combination may be shifted as desired. Such a facility allows you to customize the command structure and syntax to suit both what you are used to (with other programs, for example) and what you find easy to remember. Hams speaking languages other than English may benefit from this by translating commands into their native language, which often changes the initial letter.

Remapping may go so far as to change any letter key, number key, or control combination on the keyboard. Thus, if an alternate key arrangement, whether it be alphabetic or Dvorak, is appealing to you, TRTY can accommodate your needs.

There are 26 callable strings per session, or 52 in all, which can be called individually or in tandem through the use of control sequences placed within the strings. Written in plain ASCII, these strings are limited to 80 characters each. But they may contain short, usually two-character, control sequences to insert a callsign, carriage return, a fancy margin, another string, a transmitter turn-on signal, or some other function.

Remote control of another station, through a relay, is even possible, through the use of a WRU (Who Are You) function, as long as all stations involved are using TRTY or one of its variants.

Tested with many packet TNCs and AMTOR setups, this appears to be quite a powerful package. A listen across 80 and 20 meter RTTY the other night turned up several stations using TRTY, and several more discussing it. My kudos to T.L. Vinson and the members of the Heathkit Amateur Radio Net for making this program available.

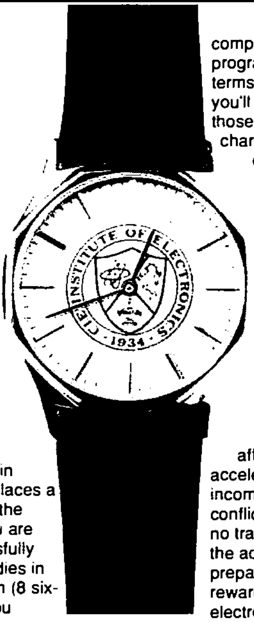
You can get your very own copy of TRTY from several sources. Certainly, the easiest way would be from another ham, or a ham club. Lacking that, the program is available both on CompuServe HamNet, and also on Delphi, where it may be found in the PC Forum, telecommunications library; and the Hobby Forum, Ham library. If all else fails, I will provide a copy to readers of this column who send me a disk, either 5¼" or 3½", a stamped, self-addressed disk mailer, and two dollars, to the above address. This will be for a limited time only, and as my schedule permits.

```
==================================================================

                      AMATEUR RADIO TELETYPE                ++++
RRRRRRRRRRRR                                               +  +
RR        RRR                                              +  +
RR        RRR                                        ++++++++++++++
RR        RRR     TTTTTTTTTTTT                       +     +  +   +
RRRRRRRRRRRR           TT                            ++++++++++++++
RR     RRR             TT                                  +  +
RR      RRR            TT           TTTTTTTTTTTT           +  +
RR       RRR           TT                TT                ++++
RR        RRR          TT                TT
                       TT                TT           YY         YY
 3 0 0 1 . 0           TT                TT            YY       YY
                       TT                TT              YY   YY
                                         TT               YY YY
                                         TT                YYYY
                                         TT                 YY
                                                            YY
                                                            YY
       SKYLINE ASSOCIATES                                   YY

    DUAL PORT COMMUNICATIONS
                                                          21:59
------------------------------------------------------------------
```

Figure. The opening logo screen of TRTY, version 3001.0.

We've got a lot in the hopper over here. A few more pieces of software, and a few more updates from things gone by. But I can always use more. Keep those comments and suggestions coming, by mail, to the above address, or via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). 73

Tick. Tick. Tick.



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Mir on Packet

Since late January, the callsigns U2MIR and U2MIR-1 have been covering the Earth with FM packet signals from the Soviet Mir Space Station. This activity was not expected until March, but there have been no complaints. Signals have been very strong, although Musa Manarov (U2MIR) turns the power down to 2 watts when the system is running unattended.

How to Hear and Copy U2MIR

Any station that is packet-ready, with a synthesized 2 meter transceiver, can hear Mir and display packet activity from the space station. HTs with rubber ducky antennas are usually insufficient for two-way contacts, but with a slightly better antenna they can at least provide good copy. Several hams have established "connects" with the onboard BBS (U2MIR-1) using mobile packet stations with at least 10 watts to whip antennas.

Mir operates on 145.55 MHz over the United States. Simultaneous activity can occur with the onboard BBS via U2MIR-1. Figure 1 shows an early example of BBS activity. (The system date and time had not been initialized, yielding "0's" for those parameters.)

Doppler shift causes signals to appear off-frequency for fast-moving objects like the space station. When Mir is approaching, the apparent frequency will be high by as much as 3.5 kHz. To counter this effect and get good copy of the incoming packets, your ground-based 2 meter rig should be set to 145.555 MHz for the beginning of any pass exceeding 20 degrees elevation. When Mir is at its closest approach, the frequency should be set to 145.55 MHz. As it heads for the opposite horizon, best copy will occur around 145.545 MHz. An FM rig with tuning increments less than 5 kHz, and a discriminator, can be continuously adjusted to give true centering on the signal from above.

Doppler shift also affects the uplink from a ground-based station. Unlike the U.S. space shuttle activity, there is no frequency offset for signals to space, but the Doppler effect will make uplink signals appear high in Musa's radio during approach, and low during departure. The easiest way to counter the effect is to transmit on 145.55 MHz, with deviation set no greater than 3 kHz. For those with frequency-agile radios, the transmitter can be set a few kHz low during approach, and a few kHz high as Mir leaves.

If the signal from aloft is heard 2 kHz above 145.55 MHz, then the transmitted signal should be 2 kHz below 145.55 MHz. For most passes, a setting of 145.55 MHz for both uplink and downlink will suffice, with minimal loss of packets. The example in Figure 1 was obtained with a simple mobile rig with 5 kHz tuning increments and a typical crossed yagi used for amateur satellite activity.

Tracking Mir is not as easy as tracking other hamsats. The space station is in a very low orbit with passes lasting no more than 12 minutes. For those with satellite tracking programs, the element sets defining the station's orbit must be updated on a weekly basis for high accuracy. Month-old data sets can give errors as much as 20 minutes off if the station has been reoriented. (The cosmonauts on Mir reposition the craft for docking with resupply ships, and to counter the effects of atmospheric drag.)

If you do not have a satellite tracking program, there have been several free offerings on various computer bulletin board systems. AMSAT, the Radio Amateur Satellite Corporation, sells many extremely good programs for several types of computers. Complexity ranges from InstantTrack for PC machines with at least EGA graphics, to simple HP-41 calculator-style programs, and everything in between. For information on the many offerings, call AMSAT's office at (301) 589-6062, or write to: AMSAT, P.O. Box 27, Washington DC 20044. Discounts are available for AMSAT members.

Getting current element sets for Mir used to be very difficult. Although NASA prediction bulletins are available for the asking, they are usually too outdated by the time they show up in the mail. The best source is AMSAT bulletins via packet radio. Every week, N3FKV puts together the latest element sets for the amateur satellites and sends them out through the packet network.

Most packet BBS's carry AMSAT News Service items, and the latest element sets. Two formats are supported: the standard "AMSAT" format, which lists each orbital parameter with the appropriate description, and the "two-line" format, which appears as a cryptic list of numbers. While the AMSAT format is accepted by most computer programs, it is most useful for those programs that do not allow automatic updating. Programs for older computers and calculators cannot support automatic updates. The two-line format is most appropriate for advanced software packages that recognize the location of the numbers in the listing and know where to place them in the element-set data strings. Either way, the end result is the same: Current orbital data is available and can be loaded and put to use within a day or two of its uploading into the packet BBS network.

In Figure 1, there is a line stating, "No third party mail allowed." This may mean that only messages for U2MIR or other cosmonauts are allowed on the system. Many times the BBS is off the air. Musa may have turned the ham equipment off for sleep periods or other reasons. He might even be available for voice contacts.

This new BBS in the sky is easy to hear and very popular. Don't be surprised when "connect" requests are met by "busy" signals, with the associated "disconnect" message. A lot of hams are monitoring 145.55 MHz and waiting for an opportunity to connect and try out their systems. QSLs for current Mir contacts should be sent to: UA6HZ, Valery Agabekov, Box 1, 375600 Yessentuki, USSR.

STS-37

The latest U.S. ham-in-space activity is about to take off with a full crew of ham astronauts. The most recent launch date information targets early April. Packet, voice, slow-scan TV and fast-scan TV experiments have been planned. A space-mobile to space-mobile voice or packet QSO from Mir to STS-37 is also a goal. For information on the system configuration and mission goals, see "SAREX-90, Ham-in-Space Shuttle Missions" by Tom Clark W3IWI, Ron Parise WA4SIR and Bill Tynan W3XO, *73*, May 1990, p. 9. Unlike Mir packet activity, the U.S. equipment typically uses a 600 kHz offset for uplink signals. For a downlink of 145.55 MHz, the uplink is 144.95 MHz. DO NOT call the shuttle on 145.55 MHz. ■

U2MIR-1 >CQ UI R>:

U2MIR-1 >CQ UI R>:CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>

U2MIR-1 >CQ UI R>:No third party mail allowed

U2MIR-1 >CQ UI R>:

cmd:c u2mir-1

*** CONNECTED to U2MIR-1
Logged on to U2MIR's Personal Message System

CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>
L

Msg # Stat	Date	Time	To	From	@ BBS Subject
77 P	00/00/00	00:00	U2MIR	WB6LLO	VOICE
76 PR	00/00/00	00:00	U2MIR	ZL1AFC	v
75 PR	00/00/00	00:00	ZL2AVK	ZL2TT	greetings
74 PR	00/00/00	00:00	VK4AGL	VK4ZF	greetings
72 P	00/00/00	00:00	U2MIR	K1HTV	Hello again Musa
71 P	00/00/00	00:00	U2MIR	WD4AHZ	Hello
70 P	00/00/00	00:00	U2MIR	ZL1TRE	Hello again
69 PR	00/00/00	00:00	U9MIR	VK3CFI	eva
68 PR	00/00/00	00:00	U2MIR	VK3CFI	more list
67 PR	00/00/00	00:00	U2MIR	VK3CFI	list commands

2436 Bytes free
Next message Number 78

CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>
?

B(ye) B [CR] disconnects you from PMS.

H(elp) H [CR] or ? [CR] displays this help file.

J(log) J [CR] displays a list of callsigns heard (optional date/time)

K(ill) K n [CR] deletes message number n (only to/from your callsign).

KM(ine) KM[CR] deletes all READ messages addressed to your call sign.

L(ist) L [CR] lists the 10 latest messages.

M(ine) M [CR] lists the 10 latest messages to/from your callsign.

R(ead) R n [CR] reads message number n.

S(end) S (callsign) [CR] begins a message addressed to (callsign).

Subject: max 28 characters ending with [CR].

Text: End each line with [CR]. End message by typing /ex [CR] or CTRL-Z [CR] at the beginning of a new line.

SR(eply) SR n[CR] Sends a reply to message n prompting only for text.

V(ersion) V [CR] displays the software version of the PMS system.

CMD(B/H/J/K/KM/L/M/R/S/SR/V/?)>

B

- Logged off

Figure 1. Example of Soviet space station Mir BBS activity.

Number 24 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

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Microwave Devices

I'd been planning to construct an RF sweeper for portable operation, mainly for use in a spectrum analyzer, but I didn't have the circuits for driving the wide-frequency YIG (Yttrium Iron Garnet) oscillator.

When the schematic was presented to me, and I'd picked up a surplus log amplifier (from a military radar test set) for the IF system, this project was off and running. The log IF amplifier, a key item in the spectrum analyzer, works at 160 MHz and gives the system 90 dB of dynamic range. The unit has 12 transistorized IF stages which feed a logarithmic diode summing network that feeds a video output amplifier. This output is the vertical input to the oscilloscope.

I bought my scope, a cardiac oscilloscope, at a local flea market for $5. It is battery-operated (12 volts) and has a very slow (long-persistence) trace, but a regular o-scope will work just fine.

YIG Description

YIG oscillators are, I feel, the "dilithium" crystals used in warp-drive oscillators from the future. The YIG crystal forms a highly polished, spherical microwave resonator less than 1/100" in diameter. It behaves like a resonant circuit coupled to an oscillator transistor, usually of common base configuration. The YIG sphere generates a very strong magnetic field about the main coil. By varying the strength of the magnetic field, you change the sphere's resonance and the oscillator's frequency.

The main coil consists of two large electromagnet coils on each side of the crystal chamber in series with the DC supply. This coil is polarized, with one DC positive lead for current drive input.

DC current from the main coil is applied at right angles to the sphere's microwave coupling loop. The YIG is fussy. If the current through the main coil is too high or too low, the circuit will not oscillate at all.

I do NOT suggest that you take a YIG apart to see what is going on inside. Although you can separate the magnetic poles in the main coil to look at the construction, to go any further requires extreme diligence.

Now there is both good news and bad news. The bad news is that these devices cost big bucks new, and you can't home-brew them. The good news is that you can get them from surplus in a frequency range from 1500 MHz to over 12 GHz. Low frequency YIGs cover just over 1 GHz, and high frequency YIGs can cover greater frequency ranges. They differ in the amount of current, from 150 mA to over 800 mA, they require to drive the magnets.

This main coil current is critical. My oscillator requires about 425 mA to begin oscillating (low frequency) and 580 mA (high frequency) to stop oscillating. Adjusting the current through the main coil from 430 to 550 mA produces a resultant CW frequency at whatever current setting you stop at between the stated limits.

Frequency adjustment of the YIG oscillators is linear and proportional to the magnetic current. My YIG, with a frequency range of 8 to 12.4 GHz and current requirement of 400 to 600 mA, was made by YIG-TEK. Frequency adjustment (magnetic) sensitivity is about 40 mA per GHz. Power output from YIG oscillators can typically vary from 10 to 100 mW. There are types of YIG's available that are not used in oscillators but rather couple in and out of the resonant sphere, or several spheres, forming a very wide-range tuned filter.

Probing the YIG

An ohmmeter revealed that the high current coil of my YIG-TEK 10 GHz measured 15 ohms. The DC bias input (oscillator and amplifier transistor power circuit) showed a high resistance and capacitor-charging characteristic. My YIG had a heater circuit of 100 ohms for the crystal.

The YIG crystal can have an additional, smaller coupling loop as the drive coil for modulation (the FM coil). It is 90 degrees offset to the oscillator coupling coil, and adds to the main coil's magnetic field.

The (oscillator) coil is coupled to the sphere and provides input to a single transistor-oscillator stage. In turn, the transistor drives a second-stage amplifier for higher output, as well as providing isolation to the oscillator stage, which reduces frequency pulling on the oscillator. Most YIG oscillators and filters are quite small, and use SMA coaxial connectors for RF connections.

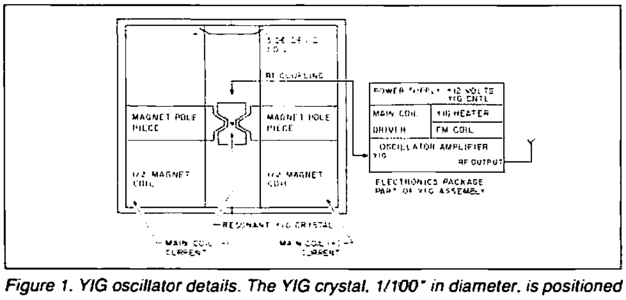

Figure 1. YIG oscillator details. The YIG crystal, 1/100" in diameter, is positioned close to magnetic pole pieces.

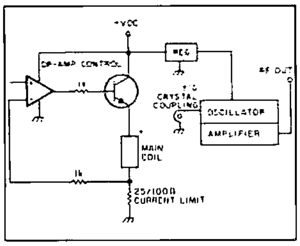

Figure 2. Basic YIG drive control circuit.

Power input to my YIG was via a DB-9 connector for all pinouts, making DC testing easy. The power connections are as follows: pin 1, +15V; pins 2 and 9, ground; pins 4 and 5, heater coil; pins 6 and 7, main high current coil; and pin 8, the FM coil input for modulation.

> **"This compact ramp generator has multiple applications."**

Some high precision types, perhaps designed for extreme conditions, have a heater in the cavity to maintain a stable environment for the YIG crystal. You don't have to connect this heater for microwave operation.

The circuit to drive a YIG includes your basic power supply with features to provide fine control. It can be made to sweep over the YIG's entire range, or be a CW source at a spot frequency. If you use it as a CW source, place a large electrolytic capacitor across the main magnet coil. The magnet coils are resonant at a very low frequency (below 30 kHz), and anything that helps swamp out the low frequency resonance improves stability. Glen N6GN gave me this little trick, and it really improves CW operation. (See Figure 1.)

John W7HQJ was willing to share the YIG driver circuits, which he assembled from multiple sources. John used three different YIGs in his sweep oscillator, which covers a broad frequency range of near-DC to 10 GHz: 0–2 GHz, 2–6 GHz and 6–10 GHz. While you might not build John's sweeper, with minor changes you can adapt his circuitry for a single YIG at any frequency.

The frequency range of 0 Hz–2 GHz is actually obtained from the 2–6 GHz YIG oscillator by limiting the sweep to 2–4 GHz and mixing a 2 GHz fixed oscillator, therefore producing a low mix product of DC–2 GHz. Of course, a small area from 0 to some MHz is not usable, due to rest frequency leakage in the RF filters. This arrangement might not give competition to Hewlett-Packard, but for our use it works just fine.

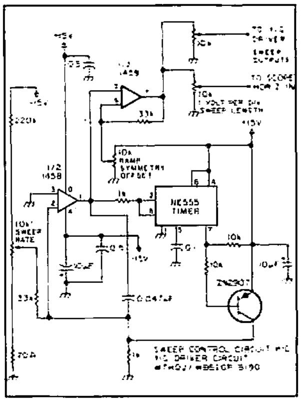

Figure 3. YIG sweeper circuit from W7HQJ.

The Sweep Ramp

This month I will go into the construction of the sweep ramp portion of the circuit. It provides sweep to both the YIG power supply control circuit and the oscilloscope horizontal drive external input. It only requires two op amps, a 1458 dual op amp, and a 555 timer chip, mounted "dead-bug" style (top of the IC glued to the board with the pins sticking up) on a single piece of PC board. The layout is helter-skelter, but easy with a little practice. Try not to stack up components one on top of the other; route leads between components in an orderly manner.

I usually start by soldering the ground pins to the foil, then adding bypass capacitors to ground on the power pins, giving the chip a support structure. Next I add secondary chips and inter-stage components between chips. You can develop a breadboard in a matter of minutes for testing. If the circuit is simple and the chips inexpensive, the breadboard might just be the final product!

This compact ramp generator has multiple applications. It offers clean sweep ramp, minimal noise output, good DC bus decoupling, variable sweep rate, adjustable offset voltage, and an output attenuator for driving an oscilloscope horizontal circuit. The YIG driver will work with almost any current range YIG. John mentioned that he has used this circuit with YIGs requiring from 60 to 800 mA.

The sweep ramp generator provides adjustments for variable sweep rates in sync with both outputs, one for the YIG driver and the other for the horizontal input of your oscilloscope. Controls for ramp symmetry and sweep length are also provided. Pin 7 of the 1458 op amp couples to both the oscilloscope's input and the power supply drive circuit. It is capable of producing a sweep ramp of +14 to −14 volts DC. A typical drive circuit is shown in Figure 2. Full details on this part of the circuit will be covered next month.

As always, I will be glad to answer any questions related to our VHF/UHF microwave bands or similar topics. Please send a SASE for prompt reply. 73's, Chuck WB6IGP

Number 25 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton CA 92633

Avoiding the Slammer

Last Saturday night, I fell into the dragnet again.

WA6OPS and I, with ride-along observer Phil Gray KJ6UV, were cruising through downtown Fullerton. We had lost the hidden transmitter's 2 meter signal upon our descent from the starting hill, but that's not unusual. It was probably at least 20 miles away, and we planned to follow our original bearing until we got in range.

Hider Wes Printz KA3DSE announced on the 220 MHz coordination repeater that he would raise the hidden transmitter power briefly for a couple of late-arriving hunters. Good, maybe we can get another fix.

Wait a minute! What are those flashing lights behind me? I'm being stopped by the police!

Two cruisers were behind me as I stopped in a nearby parking lot. The officers were smiling as they approached the van. They flashed their lights all over the inside and outside as I offered my license. What a time for this to happen—there goes our chance to get another bearing.

These wide-eyed cops were the youngest rookies I had ever seen. They looked just like the Police Explorer Scouts we see doing traffic control duty at public service events. They seemed to be in awe of the 4-element quad on top of the van, with the mast going through the roof.

"What did I do?" I asked, as April offered one of them a copy of my T-hunt information sheet.

"Nothing," was the reply. "We just wanted to see if you had a scanner in there."

"Why?" I asked, silently wondering if he recognized the Regency MX-7000 on top of the dash, hooked to the Roanoke Doppler DF box. It has only ham frequencies in it, of course. (Well, mostly.)

"We've had a lot of burglaries," the neophyte cop says, "and it's illegal to have a scanner in your car."

That was my cue to give him a friendly briefing on the fun and usefulness of competitive radio direction finding (RDF). I also pointed out that we weren't listening to his frequencies, but it would not be illegal to do so in California. One of them disappeared for a minute. After a check on the radio with the Watch Commander, he sheepishly admitted I was right about the scanners and sent us on our way. Well, at least now we had a good excuse for finishing second in the hunt.

Getting stopped in the city during a T-hunt is very unusual here in laid-back Southern California, where VHF hunts have been going on for 35 years or so. Veteran officers are used to our strange antenna arrays and slightly erratic driving. They give friendly waves as they pass by the hilltop starting points lined with hunters' vehicles, and usually ignore the fact that a couple of them protrude into the traffic lanes. Normally, it takes something blatant to get them to pull you over—like the hunter who backed down a freeway on-ramp a few years ago.

It was different in the early days. Ken Walsh K6ZRL remembers the 2 meter hunts of 1960, complete with Gonset Communicators and dynamotor B+ supplies. One night, he and several other hunters found themselves under arrest, albeit briefly. They weren't doing anything illegal, but a homeowner had complained about the strange people with radio gear tramping through the countryside. One hot-shot officer crashed his patrol car in the fog during that caper.

Worried residents still call in, but now dispatchers call the helicopter patrol to check out the scene. Several times, my hiding spots have been in the spotlight from above. Usually Angel (that's what they call the chopper) hovers just long enough to give away the spot to the close hunting teams (drat!), and then disappears.

Occasionally, it gets dicey. Four years ago, April and I hid at the site of a new home that was being built in Anaheim Hills by its owners, a couple of our friends. These folks discovered at the last minute that they couldn't be there to hide with us. We decided to go ahead anyway.

After a dozen hunters converged on the place, it wasn't long before the chopper and spotlight arrived, followed shortly by a patrol car. The neighbor who called in came over to insist that we were trespassing. We had no proof that the owners had given permission. There was a hurried autopatch call to the owners—no answer. Eventually we prevailed, but we learned an important lesson: When hiding on private property, be able to prove that it's okay to be there.

By the way, that was a great hunt from a technical standpoint. The AC wiring for the house was complete, except that there was no breaker box, and no lines to the power company. We connected the output of the fraction-watt transmitter to one of the long Romex cables, then buried the transmitter next to the foundation (see Photo A).

You have probably seen the ads: "Turn all your house wiring into a giant antenna!" That's just what happened. Everyone DFed their way to the house with no problem. Then they wandered around the property for hours trying to identify the antenna. (No wonder the neighbor panicked.) "All the outlet boxes sure are hot," they kept saying. Yup.

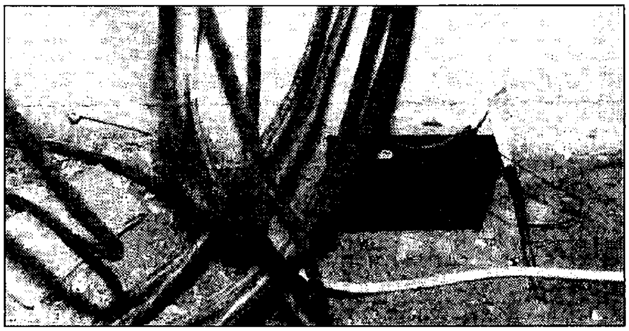

Photo. We've hooked the house wiring to the mini-transmitter's output, and now we'll bury it next to the foundation. It's going to be a great April Fool foxhunt.

Befriend a Cop

Consulting with the authorities ahead of time can pay dividends. One night we hid the little rig in an outhouse (that's right, a rent-a-biffy) in a new construction area in Yorba Linda. While setting up, we made friends with the security guard at the site. He got so enthusiastic about our prank that he let us use one of the vacant houses as a lookout post and hide our car in its garage.

For a while, Orange County hunt rules recommended advance notice to the police of the transmitter's location, so the dispatchers could reassure concerned citizens who called in to report strange sightings. That practice didn't last long. It was a lot of bother, and there was suspicion that advance hiding spot information was finding its way to some of the hunters. (I think I would have been tempted to "plant" some false stories when hiding, to see what happened.)

Certainly there are enough hams with police connections to make me think twice before disclosing my clever hiding spots. It was only two years ago that Don Lewis KF6GQ put on a hunt with the low power transmitter in a box under the reception desk at the Monrovia Police Station! All the bearings from every outside corner of the building pointed inside, of course. But, it took a lot of courage to walk through the door with a handheld "sniffer" to probe the lobby of a precinct house.

Get the Burper

Peace officers depend on their radio equipment, so they should be able to appreciate the need for RDF. Dean Hale KF7CR sent in a clipping from the Eugene (Oregon) Register-Guard, describing the antics of "The Belcher," who has been annoying the users of police and tow truck radios in 11 communities in the Monongahela Valley of Pennsylvania. He has whistled, made body sounds, and even played "Jingle Bells" on a kazoo.

So far, "The Belcher" has managed to elude DFers from the FCC's Philadelphia field office. Pennsylvania T-hunters, are you listening?

200 Hunts a Day

Bob Howle WA4ZID has an idea how T-hunters could perform a public service, save taxpayers' dollars, and add to our foxhunting fun, all at once. It all started when he discovered a 6" x 6" x 18" box in deep woods on his 20 acre property. It turned out to be the electronics package from a weather balloon.

Later, Bob had a chance to visit the National Weather Service (NWS) office in Jackson, Mississippi. He learned that two NWS offices in each state launch radiosonde weather instruments daily at 1100 and at 2300 UTC.

Bob writes: "These instrument packages are carried aloft by a helium-filled balloon and can attain an altitude of around 96,000 feet. Telemetry is transmitted back to a receiving station by an on-board transmitter that operates near 1680 MHz."

"To me," continues WA4ZID, "this translates into 200 opportunities per day to T-hunt! By finding and returning the radiosonde packages to the weather service for reuse, we could all do our part to reduce government spending (or at least get some enjoyment from same). Another benefit to DFing radiosonde transmitters would be that no one has to hide the transmitter."

Bob goes on to ask for information on directional antennas and receivers suitable for DFing these balloon-borne rigs. He suggests using a downconverter driving a 2 meter receiver. Perhaps a 1.2 GHz ATV converter could be modified for this purpose. [Ed. note: Radiosondes have been successfully DFed using a R-7000 in wide band FM mode and a small beam or dish.]

DFing transmitters, as they fall from the sky, can be an exciting challenge, as *73*'s editor, Bill Brown WB8ELK, and those who have participated in his ATV balloon experiments, can attest. The NWS radiosondes transmit a 400 mW AM or wideband FM telemetry signal to quarter wave vertical whip.

After the balloon reaches maximum altitude, it breaks and the payload parachutes back to Earth. This descent period (30–45 minutes) is the optimum window of opportunity for RDF. The range of a low power transmitter at 1680 MHz is limited once it hits the ground, unless you are lucky enough to be DFing from an aircraft. The batteries last about 3 to 4 hours, so you should have about an hour or two to locate the sonde.

So Uncle Sam is hiding transmitters for us. But radiosonde hunters (R-hunters?) will have to get a fix and get within "sniffing" range before impact. What a challenge! Do you think it's worth trying? Let me know. 73

Number 26 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
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Massillon OH 44646

The Universal Transmitter

If you have been keeping up with the QRP column these last few months, you should have two very useful pieces of equipment in your shack: the T/R controller and perhaps a Drake receiver capable of receiving some WARC bands. All you need now is a universal transmitter. Well, don't you know, that is exactly what we'll be building this month.

The transmitter is a lot different from some of the designs I've had in the past. It features five active transistors, your choice of either VXO or crystal control of the transmit frequency, a keying transistor for easy hookup, and three-stage output filtering for a really clean signal.

Most of the parts are easy to obtain. In fact, a lot of them can be purchased from your local Radio Shack store. The only problem parts will be the toroids. You can mail-order them from several companies advertising here in *73 Magazine.* There is plenty of room for substitutions of parts, so you don't have to sweat too much if you don't have a 47 pF cap. A 33 pF will work just as well. Just don't get too carried away when changing part values. The only values you should not mess with at all are output filter capacitors, of course. Not unless you want to change bands!

Output and Coverage

The transmitter will cover 3.5 to 21.0 MHz with no problem. Ten meters might be some trouble if you get a soft crystal. VXO of the crystal is possible, the only restraint being that you MUST isolate the VXO capacitor from ground. This requires an isolating mount and coupling shaft. Junk box stuff will work great. I'll tell you how I did my mounting in a little bit.

The transmitter will produce about 1.5 watts of RF. A little more or a little less, depending on supply voltage, crystal activity, and band. The lower frequencies will produce more bang than the higher frequencies because of the gain of the transistor used. My version of the transmitter drew 220 mA of current at 12.5 volts. At the time, I was using an old FT-243 crystal on 40 meters into a 50 ohm dummy load.

Four Stages

Let's look at how the universal transmitter works. There are four stages to the transmitter. An oscillator, a buffer, a driver, and the final or PA stage.

A Pierce oscillator is built around a bipolar transistor. Simple and very easy to get running. In fact, I changed a lot of the values in the oscillator and the thing still worked. The only critical part is the coupling capacitor to the buffer. You don't want to use too large a capacitor here or you'll load down the oscillator to the point of stopping it.

The next two stages, the buffer/driver, work together. Again, simple bipolar transistors are used. Transistor Q2 has some negative feedback to keep things stable. Emitter current is limited by the 100 ohm resistors in each emitter lead. The buffer transistor Q2 has an extra 10 ohms to keep the gain down a tad. Voltage to Q2 is supplied via the 250 µH choke. You can use either a commercially-made choke—any of the Miller mini-series will work here—or you can wind your own. To do this, use 18 turns of #28 on an FT37-43 toroid core. The small resistors in the supply line to both Q2 and Q3 act as cheap RF chokes.

Both stages are turned on via Q5, a PNP switching transistor. Grounding the base lead turns on the transistor and applies +12 volts to the buffer and the driver. The oscillator runs all the time and is not keyed. The 0.1 µF capacitor on the base of Q5 softens the keying. You can add to or reduce the value of this capacitor to suit your liking. The transmitter keys very well with the value shown, but it may be a bit too soft for some people.

The driver can be configured as either tuned or broadbanded. If you include the 10–60 pF trimmer on the collector of Q3, you can tune the stage for maximum power (with the best CW note). As you might well know, changing bands will require changing the number of turns, and the core type, if you go with the tuned circuit. On the other hand, if you leave the capacitor out of the circuit, and keep L4 and L5 (L4, 35 turns #26; L5, 4 turns #26) as is, the circuit is quite broadbanded. To change bands is really easy. Just change crystals and output filters.

The PA is simple and easy to get running. A 36 volt zener diode keeps the PA transistor from being zapped should the antenna not be connected to the transmitter. A three-pole filter provides excellent filtering of the output signal. RF decoupling is provided by the combination of RFC3 and the associated capacitors. The 100 µH RF choke is an off-the-wall part from Radio Shack. Without question, you could dig out the calculator and number-crunch the values and come out with an exact value of the RF choke. However, the one specified works fine.

Construction is easy, thanks in part to the fine PC board from FAR Circuits. The single-sided PC board shown here will operate just fine. The FAR board has a top ground-plane side to add a little extra stability. When using the FAR PC board be sure to connect the ground points together on both sides. Use what you have in the junk box. My PA transistor came from an old junk box CB.

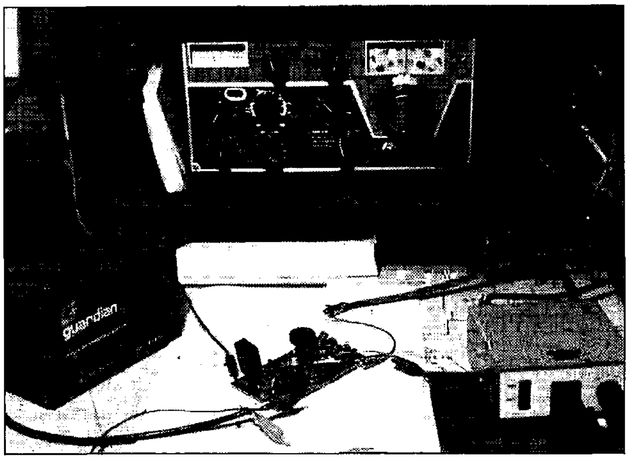

Photo. The universal QRP transmiter.

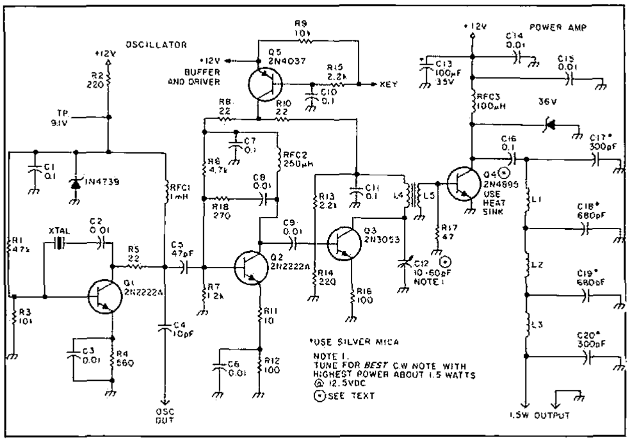

Figure 1. Schematic diagram of the universal QRP transmitter.

First, the Oscillator

If this is your first transmitter project, go slow and check each stage before going on to the next. There is little to gain by troubleshooting the entire transmitter if you can't get the oscillator to run. So, build the oscillator first. Stuff the board with the parts surrounding Q1. Connect the transmitter to +12 volts, and with the spot switch closed, check for 9.1 volts at the junction of the zener diode and the 220 ohm resistor. If all is as it should be, add the crystal. By using either a frequency counter coupled to the collector of Q1 (or taken from the 10 pF capacitor at the junction of the 22 ohm resistor and the 47 pF cap), or the station receiver, listen for the crystal's frequency.

Continue with the buffer/driver stage. Check for +12 volts at the collectors of both Q2 and Q3 when applying a ground to the key jack. Stuff the board now with the PA transistor and the output filter. With the output terminated into a 50 ohm dummy load via a QRP wattmeter (you do have one, don't you?) apply +12 to the board and

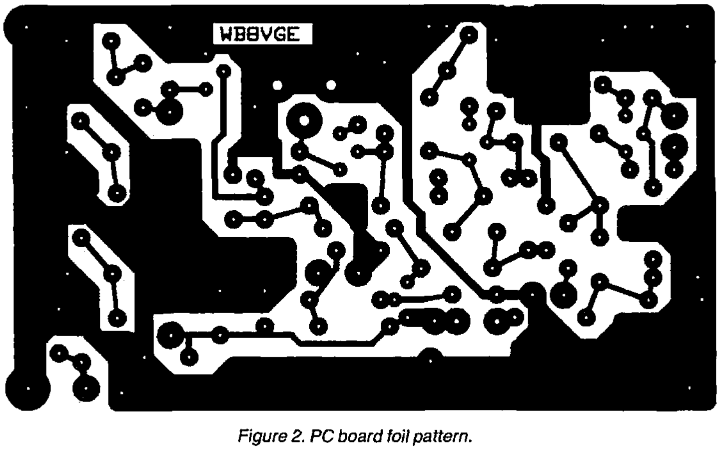

Figure 2. PC board foil pattern.

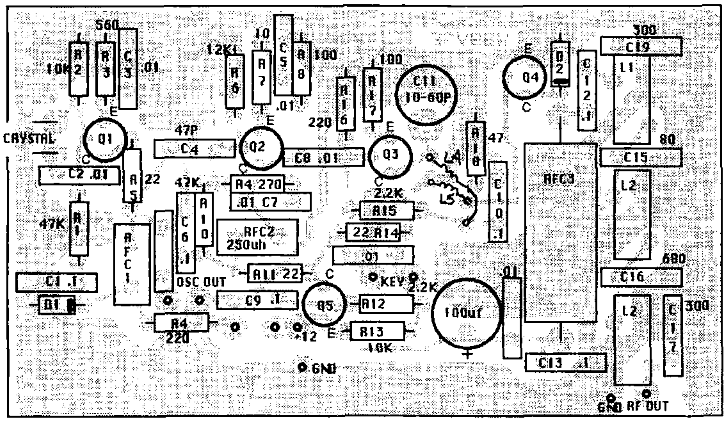

Figure 3. Parts placement.

key the transmitter. Using an insulated tuning tool, tweak the trimmer capacitor on the collector of Q3 until you have some power showing.

Don't go for max power, but rather for best power out with the best sounding tone. With a little bit of luck, you'll have about one watt or so of RF. Listen to the signal in the station receiver. It should be nice and clean without chirps, buzzes, or other noises.

If you built your version broadbanded, there will be no trimmer cap to adjust. Just add a crystal and go.

Receiving Adjustments

Before we run off this month, some notes about the transmitter. Since the oscillator is running all the time, you can hear the oscillator in the receiver. This makes it nearly impossible to hear a station calling us. So, the T/R controller will supply the +12 volts to the oscillator when you hit the CW key. If you are not using the T/R controller featured in the February issue, you need some means of turning off the oscillator during receive. For spotting the transmitter, a switch passes +12 volts to the oscillator. You can zero-beat to this signal without having to put a signal out on the band.

The small coupling capacitor from the oscillator can be used to couple a frequency counter to add a digital readout. Or you can use this output for a direct conversion receiver. Just route this signal into the mixer of the DC receiver and you're on your way to a transceiver.

To VXO the transmitter, add a 365 pF variable capacitor in series with the crystal. You don't have to remove the 0.01 µF capacitor from the board, since it seems to work the same with or without this capacitor. If you do remove it, you must place a jumper in its place. The capacitor MUST be isolated from ground. A small piece of plastic will work. The capacitor shaft must also be isolated from ground. I used a coupling shaft and a ¼-inch plastic rod. The main VXO tuning knob is connected to this plastic rod; not fancy, but it works!

All and all, this is a very nice transmitter to build and get running. The second version I built with the parts I found on the workbench netted me three states on 30 meters in less than 15 minutes. All the switching was done by the T/R controller. I added a small relay inside the transmitter to switch in two different crystals. The VXO gives me about 5 kHz of movement. That's not much, and I'm sure it's the fault of the crystals.

One final note. After four years of work, the *HW-8 Handbook* is done!! Completely re-worked with lots of new modifications for the Heath HW series of QRP radios. Lots of new modifications for the HW-9. To get your hands on one, send $7.95 ($12.95 for DX airmail) to me at the address above. 73

Parts List

XTAL	40m frequency	R7	1.2k ¼W resistor
Q1,Q2	2N2222A transistor	R11	10 ohm ¼W resistor
Q3	2N3053 transistor	R12,R16	100 ohm ¼W resistor
Q4	2N4895 (or 2N3866)transistor	R13,R15	2.2k ¼W resistor
Q5	2N4037 transistor	R17	47 ohm ¼W resistor
D1	9.1 volt zener diode	R18	270 ohm 1.4W resistor
L1,L3	17 turns #22 wire on T50-2 toroid	C1,C7,C10, C11,C15,C16	0.1 µF ceramic capacitor
L2	19 turns #22 wire on T50-2 toroid		
L4	35 turns #26 wire on T50-2 toroid	C2,C3,C6, C8,C9,C14	0.01 µF ceramic capacitor
L5	4 turns #26 wire over L4		
RFC1	1 mH RF choke	C4	10 pF ceramic capacitor
RFC2	250 µH, 18 turns #28 on FT37-43 toroid	C5	47 pF ceramic capacitor
		C12	10–60 pF variable capacitor (* see text)
RFC3	100 µH, R.S.# 273-102		
R1	47k ¼W resistor	C13	100 µF/35V electrolytic capacitor
R2,R14	220 ohm ¼W resistor		
R3,R9	10k ¼W resistor	C17,C20	300 pF silver mica capacitor
R4	560 ohm ¼W resistor	C18,C19	680 pF silver mica capacitor
R5,R8,R10	22 ohm ¼W resistor		
R6	4.7k ¼W resistor	Misc: XTAL socket case & hardware	

Note: All values indicated are for 40 meters. Values for other bands will be listed in next month's column. A double-sided blank PC board is available for $6 + $1.50 postage from FAR Circuits, 18N640 Field Court, Dundee, IL 60118.

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CIRCLE 169 ON READER SERVICE CARD

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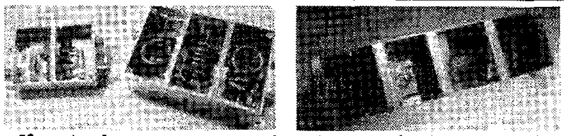
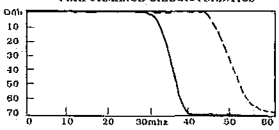


If you've become accustomed to the same featherweight, thin walled, high cutoff low pass transmitting filters sold by many manufacturers to the amateur service for decades, then you'll appreciate I.C.E's musclebound high performance harmonic choppers for use with rigs up to 5kw from DC to 30MHZ.

PERFORMANCE CHARACTERISTICS



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Notes from FN42

Ah! April has finally arrived. Here in New England that means we've made it through the winter and have come into the "mud season." It also means that it's time to start working on the antenna projects we've been planning all winter. And soon, Bill Brown WB8ELK, our resident ham balloonist, will be preparing for more balloon launches from the **73** *parking lot* [A sure sign of spring -the Ed.]. *Field Day is just around the corner, and the summer flea markets will be opening their gates.*

I hope those of you in the Southern Hemisphere, where summer is turning into fall, have had lots of fun with ham projects. If you did something special, why not write it up and send it to 73, either to me or the editorial staff? You don't have to be a Hambassador to get your name in print. Don't wait until tomorrow, do it today.—Arnie N1BAC.

DXpedition to Malpelo Island

Submitted by Ricardo Trujillo Velez HK4BHA. Last November some members of the Colombian Radio Amateur League went on a DXpedition to Malpelo Island. It took four days of hard work to pack the 10 tons of food, gas, generators, and amateur radio equipment.

The group onboard *Sebastian de Belalcazar*, a venerable ship of WWII vintage, arrived at Malpelo at 2 a.m., November 1, 1990, after 36 hours of travel. At exactly 0000 UTC on November 3, three of the planned five stations were operating. We continued operating until 1100 UTC on November 8.

On the steep side of the island, we set up the "top station on the rock" to take advantage of propagation toward the U.S. West Coast and Japan. As soon as Beto HK3DDD, Jorge KH6BDX, and Tibe HK4HHG turned on the IC-765, the JAs were booming. From that moment on, it was a solid pile-up (at times, 50 kHz wide).

Rigs used on the expedition were the IC-765, which performed flawlessly except for a blown fuse and an erratic keyer. The linear amplifiers used for 80 and 160 meters, Kenwood TL-922As, also worked fine, except for one of the 3-500Z tubes that developed a short and had to be disconnected. The TA-33M antennas were great. We lost part of one of them, and it became a TA-23M, but it still worked fine.

Ignacio HK3CC took equipment for satellite operation, including a HUGE box that contained all the antennas, fully assembled! Before getting on the ship, with a despairing Ignacio looking at us, we took the antennas apart and discarded two-thirds of the box.

When we had the satellite antennas set up, I tried to hit one of the repeaters on the Pacific coast, and after replacing a faulty connector on the downlink antennas and slowly turning the stack, I got an S-2 signal from 146.76 repeater at Horqueta mountain, near Cali, Colombia. With this link, we also had a big pile-up on the 2 meter band. Disobeying specific orders, I took my PK-232 with me, and had the opportunity to activate HK0TU on VHF packet.

After all the hard work, the results were just great! More than 40,000 QSOs. We worked 160, 80, 40, 20, 15, 10 and 2 meters. Modes were CW, phone, RTTY, and packet. We also worked OSCAR 13.

A week later, with the weariness slowly draining from our bodies, and the task of answering the QSL cards for more than 40,000 QSOs, we look back and ask: Would we do it again? The answer is definitely YES!

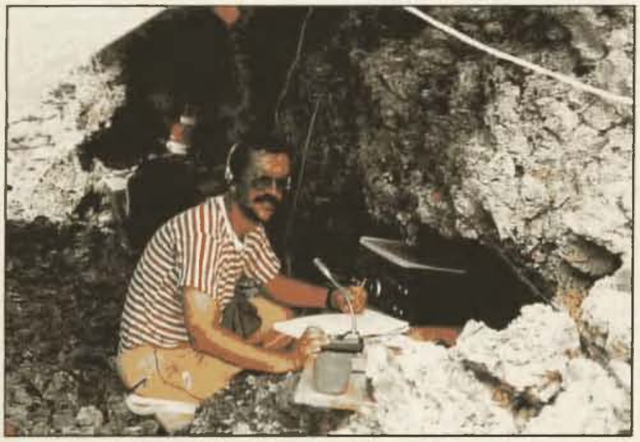

Photo A. HK4BHA operating the "top station."

Photo B. On the rock at Malpelo Island. Top (left to right): two naval officers and HK4BHA, 2nd row: HK3CC, HK5LEX, HK4DUM, HK6HFY; 3rd row: HK3AHM, HK3DDD, HK6BDX, HK1KXA, HK1HHX, HK6KKK, HK3DPY; and front row: HK1LDG, HK4HHG, HK3BED, and naval officer.

BRAZIL

Carlos Vianna Carneiro PY1CC
Afonso Pena 49/701
20270 Rio de Janeiro
Brazil

Always Fascinating Trindade Island

In a lucky mood, Tino PT7AA and Karl PS7KM got the Navy's call to go to Trindade Island just two days before the Light House Ship, *Almirante Graca Aranha*, departed on the usual trip of every two months, with supplies; and with mariners to change half the garrison of about 40 on a four-month duty period there.

Gathering all equipment and antennas and whatever else, running to their local airports praying for an extra place left free, and getting to the docks three or four hours later than specified by the Navy, after a last minute repair, the expeditioners got onboard just in time. . . after a 10-month planning period!

After an 80-hour trip, there it was, Trindade Island, where Tino and Karl disembarked from the ship's helicopter. . . . Lucky mood, as we say. . . .

We took our luggage to the meteorological station, the usual operating site on the island, and mounted the equipment and antennas so that at 1236 UTC June 11, we were able to have our first QSO, on 28 MHz, starting our log with OK3CCC, with ZY0TW for Tino and ZY0TK for Karl

As equipment, we took a Kenwood TS-130S, TS-430S, ICOM IC-725, two ground-planes for 10 to 40 meters, an inverted-vee for 10/15/20 meters, and another for 40/80/160 meters.

Even though the propagation was not so good, we were able to make 870 CW/SSB QSOs on 21 MHz, 809 on 14 MHz, and 560 on each 7 and 28 MHz, with 48 countries on CW and 57 countries on SSB. We would liked to have stayed longer, but the supply ship stays there for not more than two days, and we didn't feel that we could take two months, the time between supply ships, out of our busy schedules. So, radio amateurs have only six chances a year to get to Trindade Island, and those going on these trips are based on a waiting list. The waiting list is enormous with scientists, biologists, sociologists, oceanographers, and so on.

But afterall, if you get to Trindade Island, you'll have something really unforgettable to remember as long as you live. By the way, Trindade Island is also IOTA-SA 10 for the Islands On the Air Award.

Photo C. Tino ZY0TW at the key on Trindade Island, June 1990

Photo D. The QSL card commemorating the operation of 4X90BS at the National Stamp Exhibition in Beer Sheva, Israel.

ISRAEL

Ron Gang 4X4MK
Kibbutz Urim
Negev MPO 85530
Israel
Packet: 4X1MK @ 4Z4SV.ISR.EU

4X90BS at the National Stamp Exhibition

During the Succoth holiday season this past fall, for eight days, Beer Sheva, the capital of the Negev, hosted the National Stamp Exhibition, an event of importance to every philatelist. 17,000 visitors graced the heavily guarded show of 3 million dollars worth of exhibits, which included rare stamps, the history of mail, and collections according to themes. Although not a stamp collector myself (I pass stamps from my QSLs to my wife's parents) *[Joyce at 73 gets mine from my letters!—Arnie]*, I was duly impressed by the scope of the displays.

The exhibit was opened by the Minister of Communications, the Mayor of Beer Sheva, the general manager of the Postal Service, and other dignitaries. Each day a new stamp was issued with first day covers available on location, and a special stamp was issued to commemorate the event.

During the duration of the exhibit, special station 4X90BS was on the air. Approximately 5,000 of the visitors took the trouble to go upstairs to visit the station. They received a leaflet explaining amateur radio and inviting them to get in touch with the Israel Amateur Radio Club to join our hobby. Thirty-five amateurs visited the station, some of them leaving their QSL cards to decorate the wall.

Seven Beer Sheva hams kept the station going under the capable leadership of Shalom 4Z4UT, who must be commended for setting up the station and being on hand almost all the time. Four thousand QSOs were logged with stations all over the world. Band conditions were really hopping, as witnessed by contacts with California on 10 meters!

On the opening day of the exhibition, Minister of Communications Pinchasi visited the station, and was seated in front of the rig and photographed. Yehiel 4X6YA prevented him from speaking into the microphone, politely explaining to the Minister that only a licensed amateur may talk over the air! *[Looks like a new amateur candidate, Ron!—Arnie]* The QSL card depicts the old and new Beer Sheva, city of 130,000. At the top is the bridge over the Nahal Beer Sheva river bed, in the center ground is the new city, and in the foreground is the well of the Biblical patriarch, Abraham. This card is sent out in reply to all QSLs received. Those wishing QSLs sent directly, instead of through the bureau, should QSL via 4Z4UT and enclose return postage.

Photo E. Some of the operators at 4X90BS. Rear (left to right): 4Z4UT, 4Z9GAG, 4X6YY, and 4X6EA; front: Ziv (SWL), 4X6DE, 4X1MK (73 Hambassador), and 4X6YY's son.

Wine Cellar Operation As in past years, during the Easter/Passover vacation, the Israel Amateur Radio Club is conducting a special 100-hour operation on all bands, on SSB and CW. This year, look out for stations operating from Israel's wineries! They will be on the air from Sunday, March 31, at 0600 UTC through Wednesday, April 3, to 1000 UTC. We expect three stations: at Golan Vineries in Katzrin in the North, Carmel vineries at Rishon Le'Zion, and the wine cellar of Zikhron Yaakov.

Special callsigns, unknown at present, will be used, and a certificate will be available for those working all three stations. As soon as final details are known, "73 International" will be notified. It is possible that a small sample bottle will go along with the award! *[Looks like many hams will be busy on the bands during those few days! Me too!]* 73

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Hamfesting!

Ah, at last spring is nearly here. Some folks love the warm weather, the twittering of the birds, or the new flowers thrusting eagerly toward the sun. But we hams know better—spring means hamfests are coming!

While a good hamfest has plenty of variety, including parties, forums and lectures, the center of attraction is always the flea market. For many, myself included, nothing in all hamdom feels as good as getting that great bargain. (And nothing feels as bad as getting it home and discovering that it's a disaster!)

Of course, it's also fun to sell off your own junque to make room for the new junque you're about to buy. So, let's take a look at these activities, from both practical and technical points of view.

It's Your Move

Hamfesting is like chess. You want to sell your stuff for a good price, and buy stuff as cheaply as you can. Of course, the other guy wants to do the same thing. But money isn't the only consideration.

Before you sell a piece of gear, ask yourself: Do I really want to sell this? There are plenty of reasons to sell something, such as:

1) I need the money to buy something else.
2) It doesn't work and I can't fix it and I don't want to pay to have it fixed.
3) I just don't use it anymore.

Reason number one is the worst one. If you like the thing, don't sell it, especially if it is not easily replaced. For example, I have an ICOM IC-202 2 meter sideband portable rig I got several years ago at a hamfest. Here in northern Vermont, there is practically no 2 meter SSB activity. I have made maybe three contacts on the rig in as many years. But 202s are getting quite hard to find, so I know if I sell it, I may never be able to replace it. Heck, I might not live here forever, and my next QTH could be brimming with VHF SSB. So, here it stays. Of course, if I didn't like the rig, that would be another story.

If you can't fix something and don't want to pay to have it fixed, then by all means sell it, but tell the truth, please. Don't say it works great when, in fact, it is deader than the proverbial doornail. Sure, some hams will be scared off by its nonfunctional status, but others will jump at the challenge, especially if the price is right. The majority of the stuff I buy at hamfests is broken and cheap. For me, fixing and using gear given up for dead is one of the most enjoyable parts of the hobby. In fact, I highly recommend it as a learning tool, if you're so inclined. Also, once you set it straight, you can turn around and sell it at the next 'fest, making a few bucks in the process.

If you have a nice radio but just don't need or use it, and you're sure you won't miss it, selling it might not be a bad idea. At some hamfests, you can get good money for nice gear. At others, though, nobody comes with large amounts of cash, so you may sit all day trying to sell an $800 rig. Before you waste your time, ask around about the nature of whatever 'fest you're going to.

By the way, you will have a much better time if you go with someone else, because one of you can watch your table while the other one goes scouting around. *Never* leave your stuff unattended. Hams may, for the most part, be honest, but some are not *that* honest.

How Much Ya Want Fer That?

Once you've sold your extra gear, your wallet should be stuffed, and you will want to get to the really fun part: buying. Sometimes, you go to the 'fest looking for something in particular, and other times, you just browse. Let's look at the different kinds of things you can buy.

Parts is Parts

If you home-brew or do much repair, you need to keep a stock of parts on hand. Sure, you can get some of what you need at Radio Shack, but you'll pay retail prices, and their selection of components is limited, so you may not find what you need. Hamfests are a great place to stock up.

Most of the larger 'fests I've been to have a few people selling parts from plastic bins. The parts are new surplus, and the prices are low, low, low. I've gotten everything from resistors and caps to FETs and ICs. Almost always, the parts have been fine.

Be wary, though, of surplus electrolytic capacitors, especially big ones. Take a good look at them before you buy. If they look old or corroded at all, steer clear. Those things just don't hold up well on the shelf.

You will probably also find some unusual parts, like air variable caps, toroids, waveguides, tubes, etc. Many of these parts have such a limited market that they have all but disappeared, even at mail order outlets. And, of course, if you need a specific part for an older ham rig, the hamfest may be your only choice.

By the way, I always go to the parts bins last, because the primary hamfest rule, "Grab it when you see it, or it will be gone," doesn't usually apply here.

Computer boards, especially expansion and I/O boards for IBM-type machines, are showing up more and more. Apple II stuff is common, too. Even hard disk drives are being offered, although I'd be leery, given their rather fragile nature. RAM ICs, floppy controllers and other roll-your-own computer parts, right on up to complete motherboards and whole machines, are in great supply.

Respect for the Dead

The other great source of hamfest parts, of course, is dead gear. There's always lots of that around. Sometimes, you can pick up an old, dead rig for $2 and get a $20 part from it! If you know what you're looking for, it's a great way to go. I often buy dead VCRs, because they are loaded with good stuff and can be had for as little as $5. Heck, the headwheels are worth 10 times that alone. Occasionally, I even fix the machines and use them, but they make great parts sources for coils, caps, Japanese transistors, motors, etc.

Once in a while, you can buy something really cheap for parts, and then discover that it is easily fixed! I once bought a 15 watt synthesized 2 meter mobile rig with a nice DTMF mike for $25. The seller said it "won't transmit," so I figured on a blown final transistor at best, and serious damage at worst. I expected to use it either for parts or perhaps just for the mike, but when I got it home, I discovered that the only problem was a dirty TX/RX relay! I cleaned it and have been using the radio with no problems for almost five years now.

> ***"Hamfests are a great place to stock up."***

Need a tube? There are usually a few guys selling loads of them. You aren't likely to find a high-power transmitting tube (although it is not unknown), but there are lots of 12AX7s and the like to be had for very little cash. If you've priced tubes lately, you'll want to grab what you need at the 'fest. Some tubes may be new, but others will be used. Usually, the seller will be up front about that.

I Feel Lucky...

Buying a radio at a hamfest is always a risk. Unless you happen to know the seller, you have no idea what is inside. It could work fine, or it could be butchered and ruined by an incompetent service attempt. Typically, something will be wrong with it, but it may not be too bad. If you are technically oriented, it may be worth the gamble. If not, you are probably wisest to stay away. Naturally, if you can see the rig work, you know at least that it is not wrecked. Well, actually, not always. I once bought a walkie, at a fairly high price, after seeing it work. Ten minutes later it literally poured smoke out the bottom and died. The seller didn't care and wouldn't refund my money. Although his butcher job had mangled the radio, I ultimately rebuilt it to good-as-new status, but it was quite a mess, and I never would have bought it if I'd known. But such cases are rare. Usually, if it seems to work it probably does.

Look for obvious signs of sloppy tampering, such as stripped screws, solder burns, damaged cords, etc. Also, check to see if the rig is clean. If it is covered with cigarette residue (which is a sticky, yellow gunk), you can bet that the stuff is all over the inside, too. And, in my experience, heavy smokers tend to be the most careless with their equipment. I don't know why that is, but it seems to be so. As a general rule, try to stay away from dirty, abused-looking gear. A clean rig is more likely to be well maintained.

Ask if there's a manual included in the sale. Sometimes the seller will promise to mail it to you. He may do it, and he may not. I've bought some fairly expensive stuff and been unable to pry the manual from the previous owner. But I also remember a guy who spent $2 to send me the manual for a $5 purchase! What you want most, of course, is the schematic. If the rig is a common one, you can probably get it from the manufacturer or a local ham. If, on the other hand, you're buying a Hamatsitsi X-2900, made in 1974, you may be out of luck.

I'll Give You Three Shekels and a Lame Camel...

Bargaining is not the norm in America, but flea markets are an exception. Almost no one expects you to pay the asking price. If you have no idea what the gear is worth, ask around before you plunk your money down. If you really want the thing and need to decide in a hurry, you'll just have to wing it. You might get a popular, late model rig such as the FT-757GX for 10 to 30 percent less than the asking price. For an old, beat-up boat anchor or a dead chassis, try offering one-third and go from there. You'll be surprised at how often you can get real bargains if you're not shy about asking.

Although flea markets are sometimes called "swapmeets," very little actual trading goes on. Most transactions are for cash. But, sometimes a real trade can be had. If you've been unable to sell your own items, try offering them for what you want, especially near the end of the day. I once traded a color video camera, which had been sitting unsold all day, for a Macintosh computer. I then sold the computer 10 minutes later for exactly what I had been trying to get for the camera! Everybody went home happy.

Well, I know this month's column is a bit off my usual beaten path, but I hope this advice will help you enjoy the hamfest experience. If you've never been to a 'fest, you don't know true happiness until you've seen 8,000 people walking around with callsign hats and rubber duck antennas sticking out of their pockets. Enjoy! 73

Continued from page 4

While I'm sure that I'd have no problem in getting equipment donated, I'd rather see you pack up your own portable rigs and antennas that you know and take 'em over. This should be a people-to-people effort, not a commercial one.

Yes, of course I'll turn the promotional faucets on and make sure every newscaster is aware of what you're doing. With some good PR we might be able to attract tens of thousands of youngsters to amateur radio. At least we can make the general public aware that amateur radio exists and that it isn't just some kind of citizen's band offshoot.

I'm not talking CW or SSB here; I'm talking high speed message handling via RTTY and packet. We'll need stations on the American end in major Arab communities such as Brooklyn (NY), Lowell (MA), etc.

I've operated from the area—from Jordan, Lebanon, Syria, Iran and Afghanistan, so I'm familiar with the propagation. We should be able to relay messages from Iraq a good part of the day and night. We'll need some relay help from Europe part of the time. That's the nice part of digital communications—relaying is a snap.

I've initiated contacts with our government to see how interested they are in such an effort being organized and made ready for implementation. I think they'll like it because we're going to need all the people-to-people friendly contact we can make in order to cool off the Arab/American hostilities resulting from the war. Maybe you've noticed that the Palestinians aren't exactly cheering us on.

We'll need hams with laptop computers for message inputting. We'll need operators to keep the traffic moving around the clock. We'll need the capability to handle millions of messages, not thousands. I think we can do it.

My little Model 100 laptop would be fine for this action. It's simple to use—takes maybe five minutes to learn. It automatically counts message words and characters. It dumps to disk for message transfer to the rig's computer—probably another 100. Everything we need is small and portable enough to be carried over as luggage. I even have one Model 100 with packet built right into it.

If you're interested, let me know. In the meantime I'll see what I can do as far as working up the transportation and accreditation that'll be needed.

This will be the first real opportunity for us to provide a desperately needed high speed communications service—one which no other service can possibly handle—so I hope we're up to it. Not only can we do a lot of good toward repairing the war wounds and possibly helping ease general Arab/American tensions, but we can gain the visibility we need to assure our growth and preserve our bands. This could make the big difference we need at WARC in 1992.

How about the ARRL? Well, despite endless opportunities, they've never come through before, so it doesn't seem rational to bet everything we've got on their getting into action this time. When the big hurricane hit St. Lucia, the League never noticed. I packed up several suitcases of ham gear and sent 'em down with *73* editor Tim Daniel N8RK. Our effort helped the island get back on its feet.

I've got plenty to do without trying to organize an Iraq emergency communications system, so if the ARRL will actually do it—and will see that amateur radio gets the credit instead of the League—I'll be a solid supporter. I'm not going to hold my breath.

I'll be surprised if Baxter isn't all over this self-promotion opportunity with endless talk, reams of press releases and little action. We'll see.

My own agenda is to spend as much time as I can working toward my goals of improving independent music sales and getting a basic electronic educational course into our schools. It's just that this Iraq situation seems to provide an opportunity for amateur radio and America to both benefit.

Governments and bureaucratic organizations such as the ARRL tend to be difficult to get into action. When disturbed, they slowly move from the sleep mode to dither. If the pressure continues they'll move from dither to action. So we'll see. I want to see action, even if I have to do it. But that's a last resort.

How about you? Are you game for the adventure of your life? Or do I hear a bunch of throat clearing and foot shuffling? I noted that 95% of the Americans who signed up to go to Cannes for the recent music industry meeting canceled out in panic when the war started. Even class trips to Washington were canceled. Phooey.

Amateur radio provides many opportunities for adventure—opportunitites which are lost on most hams. Sad. There's adventurettes on mountaintop VHF expeditions. There's DXpeditions to Caribbean islands—even to tough ones like Navassa. Even hidden transmitter hunts and Field Day can be adventures.

It isn't the cost which is stopping most hams, for many of these adventures cost little. I explained how Sherry and I visited hams in Munich, Vienna, Krakow and Prague last year for under $1,000 complete. We've just gotten back from Cannes where we spent under $200 for everything, including the airfare, hotel and meals. No, it isn't the money; it's a shortage of the spirit of adventure that's keeping most hams at home.

How much does it cost to go on an African hunting safari? A fortune, right? Sure. Well, I talked two other adventurous hams into going with me on a two week safari in Kenya where we spent $690 each. We had a hunting trip none of us will ever forget. So how about a little visit to Baghdad, dad? It's a great city with beautiful mosques and a fascinating bazaar, if we haven't leveled too much of it. They'll really hook you on the taxi fares if you aren't careful, though.

Dayton? Again?

What is it that drives more than 30,000 hams to Dayton every April? Cars, trucks, motor homes, planes, RVs, motorcycles and even bicycles, that's what.

And what kind of homing instinct is it that forces otherwise crazy old men to drop everything in late April and home in on the Hara Arena on the outskirts of Dayton? What attraction is there that results in hundreds of convoys of vehicles, all sprouting weird antennas, heading in from all over the country?

Well, one attraction is the world's largest electronic flea market. There's everything there from 1920s' radios to WWIII surplus. Computer hackers have been known to lose bladder control over some of the hard disk bargains. It's a ham builder's heaven: parts, parts, used gear, modules, brand-new, old, ancient.

All the ham manufacturers are there, showing off their newest products. Ham dealers, with their razors honed, are ready to cut their competitors' throats. Their booths are hard to get to because there's always a swarm of fanatic price shoppers shuttling from dealer to dealer, working the price of some piece of gear down, dollar by dollar.

There's an ambulance on hand for hams who try dealers' patience beyond endurance... and for old-timers whose walkers have broken under the strain.

There are technical sessions for every imaginable facet of our hobby. The DXers get together and get their jollies over DXpedition videos. Indeed, one of the great attractions of Dayton is that it is the one big hamfest of the year where you can get together with others who are into your own special ham fetish.

The traffic handlers all reassure each other that it's everyone else that's crazy, not them. There's an ARRL forum which is oh, so carefully orchestrated so as not to allow any dissension to be evident. The MARS hams have in the past couple of years gotten together to commiserate over slackening military support. There's nothing like a nice war to perk up MARS, so this year we should see some smiling faces.

The slow-scanners, AMSAT, packet, RTTY, moonbounce and other groups all caucus at Dayton. The better heeled have hospitality rooms where they can get together and lie.

Yes, of course there's a Wayne Green forum. Every year a crowd gathers and I tell 'em the same thing. I explain how amateur radio is going to hell in a handbasket. Worse, I explain what happened to make it happen. You know, all the same things I write in my editorials. There seems to be no end of interest in my telling what I've written.

For some reason they keep coming back every year. Perhaps it's because they're all old and they need a memory refresh once a year to keep them going. Whatever it is, the Dayton Hamvention organizers tell me I pull the biggest audience of any forum every year.

If you'll let me know what you'd like me to talk about this year, I'll cover anything you like. I usually cover our slow growth and its effect on America. I explain what went wrong and who, exactly, did it. I then explain what we can do about it.

I do some blue sky about new technologies we can pioneer. We have so many possibilities for new modes that it's incredible. And the pioneers, if they do it right, can easily make zillions. I've personally known several youngsters who've done well recently... one is a billionaire now. Another is only worth a few hundred million. It's out there if you play your cards right.

I don't think you want me to get into any technical discussions of how electromagnetic fields can screw us up and increase our chances of getting a listing in *QST* (Silent Keys). Or an explanation of how the mind works, why it gets screwed up and how to fix it.

Sometimes I ask for a show of audience hands on various ham activities. How many are on packet? How many are DXers with over 300 countries confirmed? How many are active on 10 GHz? How many have been on a DXpedition? Things like that. It becomes obvious that we have a whole huge mansion of possibilities in amateur radio and most of us are living in one little closet and never even opening any doors.

This is why I sometimes may seem testy that over 40% of all hams have never even progressed to a General Class license. Yes, I've heard all the feeble excuses and rationalizations. Baloney. With kids of 10 making it through to Extra, we're not talking a rocket scientist achievement. Now why are you getting defensive when you know I'm right?

You know as well as I do that if you ever decided that you were going to go for an Advanced ticket, you could do it easily. It's like anything else—you have to make the decision, from there on it's easy. Decisions are difficult to make. I mean real decisions, ones you aren't going to change.

You can go on DXpeditions. You can lose 85 pounds. You can become an expert in a new technology. You can do this at 20, 40 or 60. You can become one of the best conversationalists we've got over the air. First comes the decision to do it. Then comes one heck of a lot of work. Nothing of value comes easy. And those of us who take the easy road end up with little of value ... in skills or accomplishments.

Hey, we're in need of good rocket scientists, so how about taking up that business? You don't go to school for it, you have to learn it all by yourself—like almost everything else.

Oh yes, Dayton. It's a madhouse. 30,000-plus hams, all with HTs on their belts. Two meters is jammed solid from one end to the other. It usually rains a little while on Saturday, chasing 20,000 inside and packing the exhibit areas solid until the sun comes out

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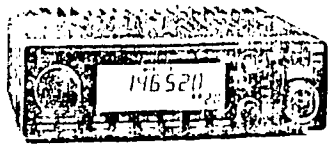

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again. Good time to eat popcorn and maybe a sloppy Joe.

Drop me a line, a fax or even leave a note for me at the *73* booth and let me know what you'd like me to cover in my talk. It'll be from 1:00 to 2:45 on Saturday. Now ask me if that's AM or PM. If it was an ARRL convention it would probably be AM. I shouldn't complain, for many years they wouldn't let me even exhibit at ARRL conventions, much less speak.

If you haven't done Dayton, don't miss another year. It's one of those experiences you'll never forget. I'll be all over the place, so watch for me and say hello. Tell you what, ask me for a "Buck-Off" worth a dollar toward any of Uncle Wayne's stuff. I'll have a pocket full to help prod you into spending some money. And you aren't going to miss my talk, are you? It's right after lunch on Saturday, so you can catch a short nap.

Wayne Makes Mistake!

Well, it had to happen! After 40 years of writing editorials I finally made a mistake. Sure, I've got a whole bunch of feeble excuses and rationalizations. But it comes down to a dumb mistake.

In my January editorial I had a nice picture of the Mobile (AL) Amateur Radio Club that I took while I was there giving a talk. I put 'em to sleep once a year when I'm in Mobile for my yearly USS Drum submarine reunion. It's a great club and they're doing wonderful work in getting youngsters licensed.

From Mobile I drove to New Orleans to look for a spot to take a good picture of Scott Kirby for the cover of his second Greener Pastures CD release. From this I managed to mislabel my club photo as being in New Orleans. Wasn't. I don't even know if they have a ham club in New Orleans. I know they sure won't talk to me over the local repeaters when I check in.

Scott's still playing every day on the streets in the French Quarter. If you get to New Orleans, say hello and put something in the hat, boy. He'll be coming up here to New Hampshire soon to record his third CD in our new state-of-the-art recording studios.

Yeah, I've gotten into the record business. My Greener Pastures Records label has issued three CDs (and cassettes) so far... two of Scott playing Scott Joplin's music and one bluegrass. My Adventures In Music label has 11 releases so far and is gearing up to put out four a month. My Auditions label has one CD almost out and a bunch more in the works. The music business is great fun and it's growing fast, despite the recession.

Anyway, I hope the Mobile club members will turn down the fires under that vat of tar and forgive me for screwing up. 73

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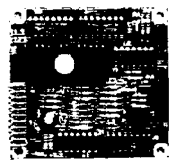

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How's the Weather?

Showing off the latest computer program or graphic creation has got to be one of the most popular ATV "programs." It's always fun to see the most recent computer goody displayed via ATV. Recently I ran across a computer program and service that really excited me since it incorporates a topic of great interest to hams: "the weather".

In previous columns we've talked about ATV repeaters that provide weather radar feeds from the National Weather Service (or from TV and radio stations). As the unsettled spring weather approaches us, it always pays to have an edge on Mother Nature. It's great to know just where those nasty storms are, and when to head for cover.

But what if you don't have a local weather radar feed available? Let's take a look at an alternative.

Enter WeatherBrief

It turns out that a computer dial-up service called WeatherBrief is available from a company called WeatherBank, Inc. The WeatherBrief service gets its information from the National Weather Service and supplies it to their customers in a readily usable form.

Other, similar services that I've investigated have cost incredible amounts of money for the initial software package along with an exorbitant connect time charge. They were really geared up for commercial forecasters. Fortunately, WeatherBrief came along to give the average home user forecasting capabilities that only your TV weatherman had in the past.

What makes WeatherBrief so unique is its really inexpensive software package (only $49) and very reasonable connection charge (as low as 20 cents/minute). In fact, some free connect time is included with the software price, making this a real bargain! They also have a toll-free dial-up number, but you'll pay more for the connect time (35 to 43 cents/minute depending on the time of day).

The WeatherBrief package gives you the ability to view all kinds of nicely done custom graphic weather maps for various regions of the country. This package runs on just about any IBM PC or compatible clone with an EGA or VGA graphics card.

One of the nicest things about the program is the ability to select just those items you want to look at. The program is designed to log onto the main number, grab the information you're looking for in the shortest possible connect time, and log you off. Once the information is in your computer, you're free to view the weather maps and save them to disk (PCX graphics format). Since all of the high-res color maps are already part of your program, only the weather data is transmitted over the phone lines, saving tremendous amounts of connect time. These are high-quality maps your local TV weatherman would be proud to display on the evening news! You'll have a great time showing off your very own weather forecasting station on ATV.

Available Maps

All kinds of weather maps can be brought up. Weather front information (both regional or national), cloud cover, jet stream location, real-time lightning strikes, precipitation (current or forecasted) as well as actual satellite images for three areas of the U.S., are also accessible.

Download time is quite fast, typically about 10 to 30 seconds at 2400 baud for each item selected. For example, I selected a weather front map, precipitation forecast, weather radar, and a lightning stike sequence. I received all these in under two minutes. Quite a bit of information for 40 cents of connect time. This quick download capability is

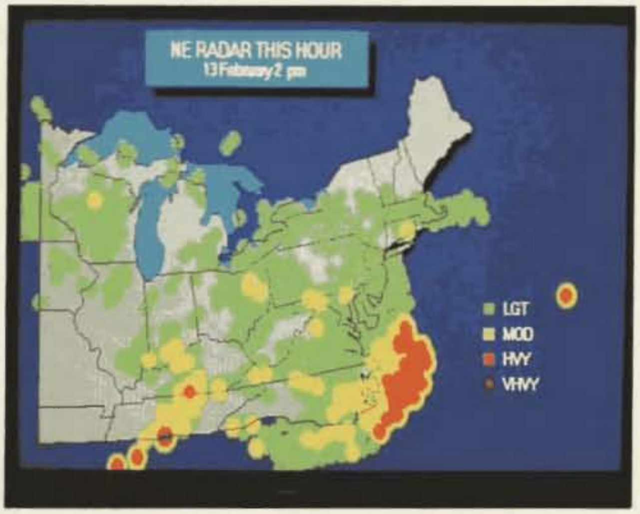

Photo A. Radar map of the northeast

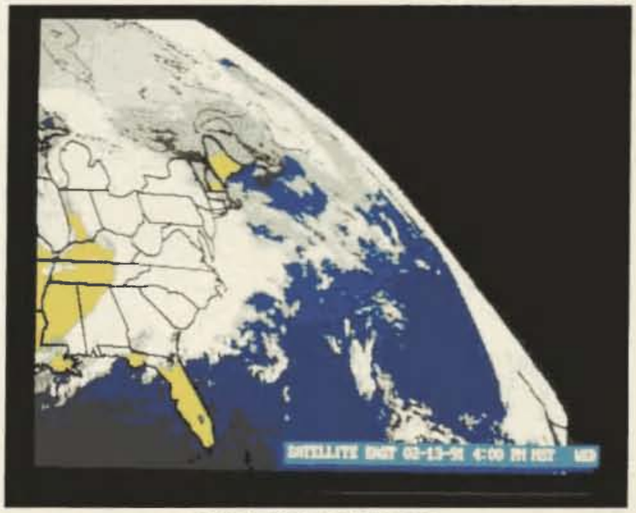
Photo C. Weather satellite map.

Photo B. Real-time lightning strikes over the southeast

Photo D. Map of the jet stream

due to the fact that the map graphics are already stored in your computer as part of the WeatherBrief software. Only the actual weather data needs to be retrieved. The only files which take a lot of time to download are the satellite images. These files are 30k plus in size and take about two to three minutes to download at 2400 baud. Also any custom map not already in your package can take some time as well. You can use a 1200 baud modem; it'll just take longer to download the information.

Once the information is in memory and you're offline, you can display the maps individually or in a continuous loop sequence.

One thing to note, however, is that these maps are divided up into either national or multi-state, regional coverage (not individual states or counties). Don't expect the weather radar screen resolution to equal that of a local weather radar feed. The resolution on the WeatherBrief maps is usually a 20 by 20 mile area. Their new version 4.0 does have the option of a single state map with 1 mile by 1 mile resolution. However there is a per month surcharge if you use this service.

ATV Uses

What can you do with this on ATV? Become your group's ATV weatherman! Know when weather trouble spots are approaching. Look at the weather radar map and real-time lightning strikes for your area, let your friends know when to unplug their antennas!

You can set up the latest version (4.0) of WeatherBrief to automatically dial-up for information periodically and display the results in a loop sequence. This would be a nice addition to any ATV repeater system. Set up a PC at the repeater site and let your whole group tune into the current weather.

Since certain weather patterns can be responsible for enhancement of UHF band conditions, try your hand at predicting the really big band openings! Hint: A clear, still and humid summer night in the Midwest with a big high pressure area stuck overhead is usually a winner.

For those of you really serious about studying temperature inversions, WeatherBrief allows you to access atmospheric sounding data from radiosonde flights nationwide. You can see the altitude and strength of the inversion just by reading this data. Also winds aloft forecasts and current wind profiles at various altitudes are obtainable in text format as well.

Where to Get It

If you can't find WeatherBrief at your local computer store, try calling Software Toolworks at (415) 883-3000, ext. 779. You can also order it from WeatherBank, Inc., 5 Triad Center, Suite 315, Salt Lake City UT 84180 or call (801) 530-3181. 73

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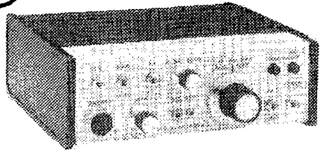

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Current DX News

According to Karl PS7KM, the Natal DX Group will activate St. Peter and St. Paul Rocks in May 1991. The list of operators includes PS7KM, PT7AA, PY5AKW, PS7AB and DJ9ZB. Karl notes that the cost of the DXpedition will be $11,000.

Next item: *DX Around the World*, edited by Larry Cox WA6AIL, is a Braille reference manual available from San Diego Braille Transcribers Guild, Inc., 1807 Upas St., San Diego CA 92103. The 55-page manual lists the current DXCC countries by prefix and name, compass headings, distance, time differences, zones, etc. Sunspot cycles and the Solar Index are also discussed. The cost of the manual (for materials only) is $4.15 (on paper) or $7.40 (on plastic pages). Thanks, "Long Skip."

Special Canadian Prefixes. In March and April, to commemorate the 100th anniversary of Ukrainian settlements in Canada, the following prefixes may be used by Canadian amateurs: VA1-8 in VE1-8 call areas; VC1 and VC2 in VY1 and VY2; VC9 in VY9; and VO7 and VO8 in VO1 and VO2. Note: The VY9 prefix is allocated for use by the Canadian Department of Communications.

Additionally, special event station VA1ØØU will be active during this period on 10–80 meter CW and SSB (possibly some 160 meter activity too); 2 meter CW/SSB or FM upon request. QSLs for VA1ØØU go to VE3IPR. Thanks VE3IPR, editor of "Long Skip."

DXing in 1990: A Brief Review

There should be no doubt that 1990 was a great year for DX. Some very rare countries, that had not been active for several years, were activated; several new DXCC countries were created; and conditions were generally quite good. There were a few disappointments, too, such as the DXpedition to South Georgia and South Sandwich Islands, which was postponed, and no DX from Albania. Perhaps this year. . . .

Bouvet Island. The year began with a bang with the 3Y5X DXpedition to Bouvet Island, one of the rarest DX countries. 3Y5X was operated by LA1EE, LA2GV, F2CW, JF1IST and HB9AHL to the tune of more than 45,000 contacts (42.2% with stations in the U.S.).

Bangladesh. JA1UT, JA3UB and others ended Bangladesh's radio silence by operating as S21U.

Bhutan. Jim VK9NS, after several years of negotiations with the Bhutanese government, put Bhutan back on the air, making almost 15,000 contacts. He signed A51JS. He is planning to return to Bhutan during 1991 (probably in May). Other operations, promised for 1990 by other operators, never happened.

Southern Sudan. John PA3CXC led a group of operators to Southern Sudan and operated as PA3CXC/STØ. The operators were John, PA3DFT, PA3CWM, DJ9ZB and IK1HJS.

Spratly Islands. A group of Soviet operators, led by Romeo UB5JRR (and 3W3RR), activated the islands during April as 1SØXV, and one or two other callsigns. The Spratly operators were later active as 3W1PZ, 3W6PY, 3W9CZ and 3W1ØØHCM. Romeo postponed another trip to the Spratlys in order to activate Afghanistan (YAØRR during January 1991).

Yemen. 9K2CS and several other operators from Kuwait operated from the newly proclaimed Yemeni Republic as 7O1AA, the first legitimate operation in many years. 9K2CS, the QSL manager for this operation, is now living in Saudi Arabia, but the logs are thought to still be in Kuwait. The new Yemeni Republic was the result of a merger between North and South Yemen (4W and 7O) on May 22, 1990. The ARRL officially deleted the two former DXCC countries of Yemen from the DXCC countries list and added the Yemeni Republic (a two-for-one swap). A second operation from Yemen during late July/early August by J28AA, F6EXV and F2VX, was signed 7O8AA.

Malawi. Operators in Malawi returned to the air after many years of silence. For some years, only Les 7Q7LS was allowed on the air, and he went QRT several years ago. It was great to hear numerous 7Q7 stations on the air again. It was especially nice to hear Ron 7Q7RM who signed ZD6RM back in the '50s when the country was called Nyasaland. Times change.

Mozambique. Lloyd and Iris, W6KG and W6QL respectively, did it again and obtained permission to operate. They signed C9QL for several weeks. There had been no legitimate activity since the two-days-per-month activity by C9MKT several years ago.

Malpelo Island. A group of operators from Colombia once again operated from this rock with the callsign HKØTU. It was a very successful operation. QSL via HK3DDD.

Germany. Effective October 3, 1990, the German Democratic Republic (Y2–Y9) was deleted from the DXCC countries list after it was absorbed by the Federal Republic of Germany (DL, DK, etc.).

San Felix Islands. Beginning in late 1990, John CEØZAM began his operation from San Ambrosio Island as XQ/ØX, a very welcome operation.

Mount Athos. SV2RE/A and SV2UA/A removed Mount Athos from a large number of need lists. They were there to train Monk Apollo SV2ASP/A.

DXCC Activities. During 1990, the ARRL received several applications for separate country status. Other applications were processed by the DXAC and Awards Committee.

Walvis Bay. (ZS9) became a new DXCC country. Grosse-Ile (CIØGI) and the Puyallup Tribe of Indians (K7SS/PTI) were not approved for separate country status.

[Editor's Note: According to Terry Robinson VK3DWZ, Mr. Barry Wilton of the Victorian Division of the Wireless Institute of Victoria informed him that a QSL bureau for incoming cards no longer exists in the State of Victoria, Australia. Please do not send any cards to VK3 via the bureau.

Next, Douglas A. Donley, KG4 QSL bureau manager, says that QSLs will no longer be forwarded to people no longer residing in Guantanamo Bay. This is because people do not keep their addresses updated at the bureau. For more information, including a list of callsigns you can currently QSL via the bureau, send an SASE to Doug Donley KB4DD, Box 692, F.P.O., New York NY 09593-0055. Remember, only KG 2X2 calls are in Guantanamo Bay.] 73

Random Output

Continued from page 96

worked great. I finally made a "real" vertical dipole out of a 19" piece of a mobile whip and copper tubing. It hung off of the curtain rod in our living room for over a year. I used the rest of the coat hanger (from the original vertical dipole) to build a basic quarter-wave ground plane. I tacked it up on the ceiling above my bedroom operating desk. Now I could work 2m from both rooms. Being on the second floor gave me enough height to make it into a local packet node, so I was on packet, too!

Determined to be a multiband operator (what good is a General Class license if you can't gloat to your Technician friends about all the great DX on 20 meters?), my antenna construction went into high gear. I wrapped the entire apartment in a twisting longwire so I could work 80m during Field Day. My wife put up with that for the duration of the contest, and I made a few 80m QSOs, but it was impractical for permanent installation.

I wrapped a multiband folded dipole around the bedroom ceiling. It was made entirely out of 300 ohm twin-lead. . . and it didn't work.

I spent all afternoon wrapping wire around an 8-foot pole, contructing my own helically-wound vertical. I wrapped about 130 feet of wire and attached 12" of whip to the top. Unfortunately, living on the second floor didn't make for the best grounding system. I cut counterpoise wires for every band and wrapped them around the base of the room. (As far as I know, the counterpoise wires are still hiding under the rug in that bedroom. It was too much of a hassle to dig them up when we moved, so I just left them.) Reception was pretty good, but I couldn't touch anything that even looked like metal without receiving a jolt that sent my heart into overdrive.

I finally decided that a loop was the way to go. I wrapped the room with a horizontal loop, fed it into my antenna tuner, and fired up. The antenna loaded fine. So did the TV, the telephone, the microwave, the stereo, the toaster oven, the blender, and the landlord's cat. I think maybe the ground controllers at the New Haven airport also had a few unkind words.

Still holding out for a loop, I strung a 10m, full-wave loop vertically around the bedroom window. With a jumper wire at the top, it also gave me a dipole on 20. I fed it with 400 ohm ladder line into my tuner. 10 meters. . . . no problem. 15m. . . Hey, I just worked four countries in Western Europe, and that's a Venezuelan calling me! This is great! 20m. . . "You're a little weak, old man, but I copy 100%." I'll accept that. 40m. . . SWR a bit high, but 5 and 9 reports all over the Eastern Seaboard.

That little loop stayed up for the rest of our time in that apartment. It caused terrible TVI on any band but 10m, so I had to self-monitor my operating times so as not to bother the neighbors. . . or the landlord. I worked close to one hundred countries on that indoor loop, including a few semi-rare ones pulled out of pile-ups. Even in the middle of a busy pile-up, I would always mention the indoor loop, and the DX amateurs would always stop the "5 and 9, QRZ" stream to ask a question about it or compliment my determination. A few of them even mentioned it on their QSL cards.

Now that we live in the country, I finally have a few normal dipoles strung up in the trees at a respectable height (though it cost me about 2,000 mosquito bites to get them up). I get a pretty good signal out on every band except 80m and 160m. . . and I do OK on 80m if the wind is right, if there's ice on the antenna, and if I'm careful with the antenna tuner. I can work Europe, Asia, South America and Africa any time the band is open. I'm not a "Big Gun" on any band, but if I hear it—and there's not an incredible pile-up—I can work it. I have my own radio room, so my wife doesn't have to put up with a wall of wires in the bedroom anymore.

I've been thinking about stringing up a LONG longwire—like a couple a' thousand feet—now that the warm weather is here. We've got the land, and I could spend all summer experimenting, adding a few hundred feet every weekend, but it's hard to get motivated when you're already doing fine with what you've got up.

I miss my indoor loop. 73

Number 32 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Some Weird Antennas I Have Known

Ah spring. . .when a young ham's fancy turns to antennas. You folks in southern climes have no idea what it feels like to live through a long, cold winter—watching the ice build up and strain your antennas, knowing that it will be several months before you can repair any damage. When the mercury starts climbing again, the ice on the lakes is all but gone, and the only snow left is the stuff that lingers in the shadows under the pine trees, we in the North can't wait to get out the ladder, slingshot, climbing belt, bow and arrow, and fishing line, and start stringing copper wire. The local hardware store quickly runs out of aluminum tubing, as the sweet sound of hacksaw blades cutting into metal can be heard.

As the spring antenna bug bites once again, I got to thinking of all of the antennas I have tried. We tend to associate the passage of time with certain things—popular songs, political events, the birth of children. I guess a ham marks the passage of time with the different antennas he has used.

The first time I put my own callsign out on the air, I was operating an HW-16 into a 15m dipole. That in itself wasn't so unusual. . .until you got a look at the dipole! It was made out of a spool of solid 24 gauge wire, bought at Radio Shack for about $1.49. Its insulation was bright red. It was fed with about 6 feet of RG-58 coax, and it was about three feet off the ground. It came straight out of my first floor bedroom window and was tied off to a fencepost on one leg, and to the branch of a bush on the other. I ran in and out of the house, trimming one-quarter inches, until I hacked off too much. Then, of course, I started adding pieces until I got a respectable SWR. My mother let me keep that antenna up for quite a while, bless her. My dad had to duck under it to mow the lawn. I didn't work any DX with that antenna, but I did work as far away as Texas. I was ecstatic!

A year or so later, my dad got his ticket. You have to understand something about the men in my family—we don't do anything halfway, especially when it involves gadgets, gizmos and anything that requires electricity to operate. Just ask my mom, my wife, or any of my sisters-in-law. The Cassidy boys just can't resist anything with a panel meter or an LCD on it. Needless to say, my dad quickly took to amateur radio.

One of the bedrooms became the radio room. An HW-101 and all of the matching accessories took their places on a custom-built desk. Upon the swift and inevitable upgrade to General Class, the various dipoles strung at the proper height off the peak of the roof were joined by a rooftop tripod tower and a triband beam. After a while, a complete Kenwood station replaced the homemade Heathkit stuff. It was a high school ham's dream: A beautiful, state-of-the-art station. How many members of my high school radio club could even compare their stations to this monument to global communications? And. . .it hadn't cost me a dime. Dear ol' Dad had provided everything. All I had to do was sit down and power up.

Wrong!

I never got closer than the kitchen to that dream station. Dad chased counties. He chased DX. He chased me right out of the operator's chair! Oh, sure, I snuck in a few QSOs after school, before he got home from work, but Dad took the unbelievably short-sighted attitude that he should actually be able to use all the stuff he bought, built and paid for.

During and after college, I was more concerned with partying (during) and paying bills (after) than amateur radio. It wasn't until after I was married that I was re-bitten by the radio bug. It's then that my antenna building became an obsession.

Dad's old HW-101 was still sitting around, so a rig was no problem. Putting up an antenna was a definite problem. We were living in a one-bedroom, second floor apartment in Connecticut. The first floor of the building was a busy florist/garden center, with a parking lot all around. All of our windows looked out over a busy street, so hanging a wire out the window was out of the question. At this point, my antennas started becoming weird.

First, I wrapped dipoles around the bedroom. That was OK on 10m during the peak of the sunspot cycle, but I wasn't getting out on any other band. Next, I tacked up a random length of very thin wire outside the bedroom window, along the front of the building. Aha! An outside antenna. . .and the landlord couldn't even see it. With my wife holding onto my legs so I wouldn't fall out of the window, I stretched every inch I could out of that wire. I ran back to the rig, fired up the HW-101, and started turning knobs on the antenna tuner. I got a beautifully flat SWR on 10m, but couldn't get any other band to tune up.

Working the local 2m repeaters was easy, even with 5 watts and an HT. I threw together a twin-lead J-pole, which worked but the SWR was too high. I taped a horizontal dipole to the window. Being on the second floor and close to several repeaters, it worked OK but looked kinda' strange. I finally decided that a vertical dipole was the answer. The first one used a piece of coat hanger for the top. The bottom half was a cardboard tube wrapped in tinfoil. It looked like something out of a 1950s science fiction movie, but it

Continued on page 92

Number 33 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

First Two Weeks Best

April ought to provide some excellent DX for your logs. However, looking at the table, you can see that the first couple of weeks will be better than the last couple of weeks. Overall, there will be good and fair days intermixed in a generally poor outlook for each week.

April has traditionally been a good month for propagation on the HF bands. Once again, you will find the 20 through 10 meter bands open from shortly after dawn to shortly after dusk on many days of the month.

Last month we talked a bit about using the charts with WWV announcements to plan your DX efforts. Here's the way I work them: First, I look on the daily chart for those days marked "Good," and verify the forecast by monitoring WWV at 18 minutes after any hour for trends in conditions.

Second, I use the band-time-direction chart to find the most likely times that the HF bands will be open to a specific area of the world. As you can see, some areas are open on some bands and not others, and during a specific time. I choose the band most likely to be open in an area, and listen slightly before, during, and after the times indicated. Sometimes a higher frequency band will open up sooner than expected.

If you like the WARC bands, as I do, then look at the chart for 15 meter conditions and expect similar conditions on 17 meters. Sometimes the 10 meter band will be a better indicator of conditions on 12 meters, but also check 15 meters to see what's coming through. Thirty meters is an evening and early morning band for DX, and a short-skip band during the daylight hours.

In April, my best guess is that between the 20th and 25th, you might do better to take up another hobby temporarily, as the bands should be extremely poor. . .but there's always a chance that the forecast will be wrong, so check the bands anyway! See you next month, and happy DXing. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20[1]	20[1]	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20[1]	—	—	15[1]	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40[1]	40/80[1]	40[1]	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15[1]	15/20[1]	—	—	—	—	—	15/20[1]	15[1]	—	—	—
JAPAN	10/15	15	20	20	20	—	20[1]	20[1]	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	10/15[1]	—	20[1]	20[1]	—	—	—	—	10/15[1]	10/15[1]	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R.	—	—	—	—	—	—	—	15[1]	15[1]	15[1]	20	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/40	20/40	20/40[2]	—[2]	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15[1]	20	—	—	—	—	—	15/20[1]	15[1]	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/40	20/40	20/40[2]	[2]	—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/40	20/40	20/40[2]	[2]	—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20[1]	—	—	20[1]	20[1]	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days. (1) Possible opening on this band on "G" days. (2) Try 80m
Note A: Use values of 10/15 for 12m; 20 for 17m; 40 for 30m. Note B. This chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

APRIL 1991

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G–F	2 F–P	3 P	4 P–F	5 F	6 F–G
7 G	8 G	9 G	10 G	11 G	12 G–F	13 F–P
14 P	15 P	16 P–F	17 P–F	18 F	19 F	20 F–P
21 P	22 P	23 P	24 P	25 P–F	26 F–G	27 G
28 G	29 G	30 G				

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LETTERS

From the Hamshack

Joseph W. Bento N6DGY, N. Chicago IL Do things never change? Or should I put it, does the ARRL never learn from mistakes? I recently picked up a 20-year *73* collection (1960–80) and have been enjoying your old editorials. Old doom and gloom Wayne actually knows what he is talking about. The vast majority of your predictions from the '60s are a reality today. You said 220, use it or lose it in the '60s. The ARRL's incentive licensing scandal. Thought I'd let you know how right you've been all these years.

It is fun to read those old editorials. On the doom parts I wish I'd been wrong . . . . Wayne

Marv KB9KYV Several months ago, after receiving my Novice license, I subscribed to *73*. I find it to be quite interesting and informative, especially your editorials on the state of the ARRL and the ham bands, electric blanket nightmares, the electromagnetic/cancer connection, microwaved brain cells, ad infinitum. I'm feel that I'm getting a perspective on ham radio that I would not get in another publication. I am a computer teacher, and can certainly see the value of including radio theory in the school curriculum. As for project building, I do like to experiment when I find the time, but keep in mind that readers such as myself may not have the level of expertise that the hams who are writing the articles have.

Noted. By the way, "time" is a rationalization. You have the time to do what's important to you. It's not time, it's priorities. We all have the same 168 hours a week. . . . Wayne

Name withheld, ARRL employee "I get tired of all the lids complaining on packet, SSB, CW, etc., about 'those idiots in Newington.' If they put half the effort into at least writing to their directors instead of bitching over the air, they'd probably be much happier. You try to solve problems, the world will be a better place. Keep up the good work and keep on bashing the lazy members."

W. Richard G. Duane, Jr. WB2VAT, Long Valley NJ I was amused by what your staff did to Dave's (W5UN) article, "Two Meter EME Primer" in the March issue. On page 52, bottom of column 2, the word "libration" (the oscillation of the moon's face as seen from earth) was changed to "libation" (drinking)!

I agree that libration effects are short-term. However, I do not agree that libation effects are very short-term! I enjoyed the article all the more for the laugh it gave me unexpectedly in the middle of a very informative and interesting piece.

If only all our mistakes were so entertaining! . . . Linda KA1UKM

Walter Lindley NL7VM After all your nagging I have finally upgraded from Technician to Advanced. It seems that everyone who talks about code claims it is either easy or nearly impossible to learn. Nonsense; code is tough to learn, but with some practice it *will* come. I think a codeless license is great because technically-oriented people (as opposed to code-oriented people) are needed in this hobby. Let's all welcome any new people attracted to ham radio through the no-code license.

Malcolm G. Bowen VE6MGB, Ft. McMurray, Alberta I just finished reading "Random Output" in the January 1991 issue, and I would like to shake your hand!! I agree with you wholeheartedly.

In November 1989 I became interested in amateur radio. I approached a member of the local ham club, and he was very helpful. I purchased a used FT-101 at a garage sale from a ham operator and it turned out he became a good friend. A month or two later, I joined the ham club. I was informed that night classes would be starting soon.

I turned up the first night along with 12 other people. The second week, only 10 turned up; the following week, six came, and in the last 10 weeks of the 18-week course, only two of us showed up. Myself and the other participant appreciated both amateur operators teaching this course, and expressed our thanks. I took my exam and passed, the other person didn't try the exam.

Now this is the part that burns me, and I have told all the club members so!! At a general meeting at the end of summer, 18 people turned up, and we talked about everything. But not one word about myself and the other gentleman sticking out the night courses through winter at −25 degrees, or even that I had passed my exam. I waited until the meeting ended, and there was nothing said, and I swore I would never attend another club meeting. Can you imagine how a new member would feel in that kind of atmosphere? I thoroughly enjoyed your article and found myself agreeing with everything you wrote. Thank you for your patience and the opportunity to voice my opinion.

Thanks for sharing your experience. Unfortunately, we've received dozens of similar letters. I'm glad you told your club how you feel. Maybe it will help (but I doubt it).

What struck me most about your letter was the fact that your licensing class took 18 weeks. 18 weeks!!!??? No wonder you had so many dropouts! If it's run correctly, it shouldn't take more than 8 weeks (or is there something peculiar about the Canadian license that requies 1/3 of a year to learn?). . . . David N1GPH

Fred Smith K3MOA, York PA After following the code vs no-code debate for what seems like an eternity, I am pleased to see that the FCC finally made the most logical and rational decision on the matter. I am one of the many unfortunate ones who had to suffer through learning code to obtain my license, but I would not wish that "rite of initiation" on my worst enemy. . . . Though the FCC has made its decision, I expect that the debate will go on forever or until the code fanatics die off. Max Planck summed it all up when he wrote: "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it."

I hope that we are able to spawn that new generation so that amateur radio doesn't die out with the code fanatics.

Nice quote. Max was too science-oriented. The quote holds water even when you take the word "scientific" out of it. . . . Wayne

Joe Plitnick KA1WPD, S. Meriden CT While attending the 31st Tropical Hamboree Amateur Radio/Computer Show in Miami, Florida, a situation developed that I think is quite amusing. While visiting your exhibition booth I was given a copy of *73* at no charge. I really appreciated it and I signed up for a subscription. While visiting other displays I came up to . . . *[another ham magazine.]* It was kind of strange to see that they were charging one dollar for their current issue. I commented to the staff working the display that I received a free copy of *73*. The reply was, "Well, that's all it's worth." Amazing. I have since decided to stop purchasing this magazine and sister publications. I enjoy your *whole* magazine. Thanks again for the free issue. Keep up the good work.

Hi, Joe—I remember meeting you in Miami. This kind of adolescent name-calling has been going on for years among the major ham magazines. Kinda' stupid, isn't it? . . . David N1GPH

E.J. Kidd, III, WD4ILS, Naples CA Over the years, I have been a retail purchaser and subscriber to your magazine. I have never agreed so completely with your observations on the general wrong-headedness of many of our ham brethren.

Every leisure activity which can be divided into groups seems to suffer from periodic infusions of petty authoritarians bent upon enforcing the "rules." Small Minds will find a way to smite the assembled faithful with the Rules, and attempt to convince them that some particular loss of individual freedoms is Good For Them.

There is a scatological Southernism that, to paraphrase it, attributes the desire to enforce discipline upon smaller groups to a void in one's sex life. So, for years I have assumed that old men with callsigns from the first and second districts, holding ARRL posts and Extra tickets, tended to be petty authoritarians and general noxious busybodies because the lack of ultraviolet rays in the Northeastern winters attenuated their libidos. What a revelation, if your hypothesis is correct! Facing Newington and genuflecting five times daily doesn't make one an old fart: CW makes one an old fart!

Having read much on EMF and cancer, becoming interested due to your editorials, I often chastise emergency services workers and hams for using those cute microphone/rubber duck antenna combinations which they gleefully pin and clip to their lapels and epaulets. Two meter energy radiated 8" from one's eyes is probably not a great idea; 70cm radiation from an antenna closer to the brain than the elbow can be shown, according to some tests in the '60s and '70s, to be hazardous to one's eyesight. But *what* does the emission of 800 MHz cellular telephone signals from all those Nokia and Motorola units up right next to the ear do for the brain? Can we expect a Yuppie Brain Disorder in the 21st century?

The current ratio of Agreement/Disagreement between the NSD editorials and my own views is running about 70:30 in the last five years. I find this an alarming trend, inasmuch as I celebrated my 40th lap around the sun last year. Instead of a young, wild-eyed Cracker who disagreed with you about 70% of the time and burned the tires off my mobile, I now look like Wilfred Brimley, find more wisdom in the counsel of those with more experience, and am trying to cut my own personal dependence on foreign oil by a few barrels a week. Not quite ready for Old Farthood, I did reregister as an Independent this year.

It's interesting that your agreement factor has risen with wisdom—why, it's almost enough to make a person think! Perhaps it's time to dig back through old rags and recheck old editorials and see how well they've withstood the test of time—vs your take at the time. Please advise. . . . Wayne

Michael A. Sciomacco N3HUX, Pittsburgh PA I've been a *73* subscriber for a year, and I've gone from nothing to General in 13 months. I am using your advice about bringing ham radio to my students at the Greenway Middle School Teacher's Center. This past summer I instructed a Novice class sponsored by the New Futures extended day program, and elmered a new Novice, Brian KA3WXH. I am currently starting a new Novice/Tech class. I am also awaiting the installation of our Cushcraft vertical to get on 10 meters.

During a recent demo at Greenway, I had a real life emergency that required me to contact 911 and a child's parent through 2 meter autopatch. A student had fallen down a hill and cut her foot open on a broken bottle. The students were able to view firsthand how I was able to lend a hand.

I also occasionally take check-ins for a local swap and shop repeater net. This gives me great personal satisfaction, and I feel all hams should contribute to our hobby in whatever capacity that they can, and not look down their noses at the young. I.E. "Lids"! (We have a local club that screens their applicants and will not admit young hams. What a crock!)

Thanks for your inspiration. I am becoming an "unreasonable" person.

Ervin L. Sly, Nipomo CA Have been reading your editorials for a long, long time, and even though I don't always agree with everything you say, I enjoy them. Have always been very envious of all the things that you do, *but* it takes money to do it with. I "just ain't never had none of that stuff to do all those things," and your March editorial finally told me why. Just don't have the I.Q. for it!

I have had Advanced ticket for 51 years. I just retired a few years back, and I had to spend what little I made on my family, and not extras, like the hobby or traveling. Guess it's too late now to get smart!

I hope the no-code ticket brings in lots of new hams.

MAY 1991
Issue #368

73 Amateur Radio Today

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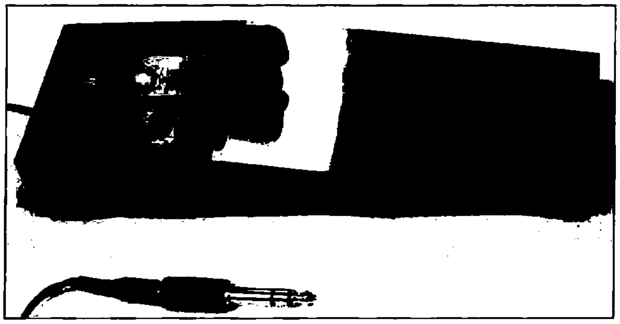

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Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

FCC Screws Up!

The FCC has tried to kill an ant with a sledgehammer. Actually, though I'm dumping on the FCC, it's mainly our own fault that this nonsense happened.

By now, unless you've been living in a black hole, you know that a ham who was protesting our attacking Iraq sent a message through a packet system asking people at the other end to make a 900-number call. Since there's a charge for 900 calls, an FCC engineer, alerted to this terrible crime, started issuing fines right and left, and in general dumping on a number of hams whose packet stations relayed the message. Talk about overreaction!

Yes, it was in bad political taste to question President Bush's decision to clobber Iraq. And yes, we're not supposed to use amateur radio to generate money lor causes. But the crime here was more on the order of a yellow-line violation than a hanging offense. We've been used to hearing worse attempts at using amateur radio to sell things than that. . . like those endless solicitations for subscriptions to a ham magazine (not mine, darn it) via supposed information bulletins.

For years we've bragged about how great we are at being self-regulating and self-policing. Then, whenever an Extra Class CW-crazed ham goes berserk on the air, the first thing we do is go whining to the FCC, demanding they put the SOB off the air. Do we do anything about It ourselves? You bet we do! We sit there, wringing our hands and complaining for a while before we telephone the FCC.

The FCC engineers, delighted to find an incident where they are on the moral high ground for a change, have leaped Into this mess with an atom bomb to pacify a flea. FCC, get the heck off our backs and stop being dumb. Yes, we know we're not supposed to handle messages that involve making money for someone. That doesn't mean that some ham somewhere isn't going to do it. And it doesn't mean that you have to close down the hobby just because we have a few idiots.

A message going through a packet system, no matter how illegal, isn't going to do a lot of harm. Let's put this baloney into perspective. Most ops don't even bother to read the traffic being relayed through their stations. Like a repeater, they're providing a service.

So what should we do? Is it time to start trying to write new regulations that will allow us to cope with this dire emergency? Or is it time to stop being silly? I vote for the latter. We need fewer regulations and less unneeded harassment from the FCC.

If we are such wimps that we can't handle the creeps who've been screwing up 20m with unwanted broadcasting, officious net jamming and pile-ups on DX, then we deserve all the miseries we have. Yes, of course the ARRL could do something about it. I happen to think they not only should, but that it's their responsibility to keep our bands clean. And I think ill of you for being a member and being too afraid to tell them what you think. . . and for endlessly voting for directors who refuse to do anything.

Now tell me how you don't agree with everything I write. What part don't you agree with?

When I Grow Up . . . ?

Yes, I know, most of us are in our 60s and it's difficult to remember when we were kids and we'd wonder what we might do when we grew up. But suppose you get into a position where you are going to be a mentor to a youngster—what kind of advice would you give?

It's difficult to look back from retirement age and assess what we've done with our lives. It can be even more difficult when we think about what we might have done.

If you were to be in a position to mentor teenagers, what guidance could you give them? Could you point to your own success and the impact you've made on the world as an example of what's possible for them?

What did you want to be when you grew up? Did you make it? Or have you gone on way beyond anything you imagined? Or have you fallen far short of your dreams?

If you're short, is it loo fate to try again?

Amateur radio can be the key which unlocks a lifetime of excitement and growth. When my friend Alfie and I were given a box of old radio parts one Sunday in church, Alfie had little interest in the junk, so I took it home. The "angel" who gave that box of old parts to two kids that day changed one of their lives.

I joke that one of the great tragedies of my life was when the *Popular Mechanics* radio I built with those parts worked. It was a turning point. Perhaps this is one reason why I'm so anxious to touch as many kids' lives as possible with the magic of radio.

How can a teenager understand enough about how life works to set any realistic goals? Perhaps, as a mentor, we who've been through it can help explain about the attractiveness of the pitfalls. How can we get across the Importance and the fun of learning when kids are up to here in lousy teachers, menacing peers, impossible parents, and threats of war and destruction?

How can we explain in terms they can understand that there are an infinite number of ways in which the world will try to head them off? That Darwinian survival of the fittest really does work, even on a personal level?

We have a wide variety of drugs for the body and the mind, all geared toward keeping them from success. There's alcohol, which their parents, television and the movies try to convince them is cool. Smoking doesn't have quite the cachet it did a few years ago, but with the uneducated it's still cool. Junk food and overeating are pushed at us from every side.

How about junk food for the mind such as ball games (of all kinds), 95% of the television fare, most movies, comic books and most newspapers? There are a lot of junk books too. . . and junk music.

How easy it is to get involved with shortcuts where you substitute a belief for the more difficult work of learning and understanding. In this category I'd put politics and every religion except yours. I've put together a whole long list of very worthy causes, any of which can derail your progress through life.

I'm as aware as you of the dangers to Gaia. I keep up on the redwood loss, the rain forest destruction, the whales, dolphins and baby seal losses, the greenhouse effect, and even that poor little snail darter that sidetracked a billion dollar dam project.

Yes, I see how the world is coming apart. I know about the race problems all around the world, the tribal enmities everywhere. The wars in Iraq, Timor, Chad, Somalia, Ethiopia, the Philippines, Central America, New Guinea. The killing of students In China and Burma. And many of these are personal with me because I've visited these places and have friends in them.

My ham friends in Czechoslovakia and Poland, whom I visited just last year, are deeply Involved on a daily basis with the turmoil in these countries, so what's happening in Eastern Europe is more than a passing news item for me. I've been to Wenceslaus Square in Prague. I've seen the hundreds of candles burning for those killed in fighting communism. I've sat and talked, ham to ham, with the people who are living through this terrible period.

Amateur radio has a whole world to offer, if only you can get this message across to the youngsters around you. It isn't easy. They're probably much more interested in Nintendo and collecting bubble-gum cards.

How much do you know about amateur radio? How much have you taken advantage of this cornucopia of wonder to expand your own horizons? How can you communicate the wonders amateur radio offers if you've never yourself even tried them?

Can you get up In front of your ham club and explain how RTTY works? Are you comfortable with bauds and digital communications? How'd you like to tackle spread spectrum for the club? How about writing an article on it for *73*? Or even a book? Why not? I've written many articles and books on RTTY, so why not you? Oh, *I'm* different in some way? How? Why?

Yes, of course I'm different. We're all different. But we all have to accept responsibility for the way we are—and change it if we're not satisfied.

When I was growing up I hadn't a clue as to what I wanted to do. Which was just as well, since most of the things I've done couldn't have been predicted. How could I imagine as a high school student getting involved with amateur radio that this would lead me In a few years to being an electronics technician on a submarine in the middle of a war?

Television was just barely starting when I was in high school so how could I guess that I'd become a TV director a year after getting out of college? Or that I'd become a professional psychologist a year later? I wouldn't have believed it! And then a couple years later I was the partner in a million dollar loudspeaker manufacturing business. Things like this are completely unpredictable, aren't they?

Or are they really? Yet wasn't I following some general goals all along? Most of my life was determined when that box of radio parts was given to me in church that Sunday. Yet even then I was ready for it. Alfie had the same opportunity, but he wasn't able to take the next step. How about you? Are you missing opportunities the way Alfie did?

Through the magic of amateur radio I've sat and talked with a king in his

Continued on page 73

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

New Rules Sought

The FCC has accepted a petition requesting that primary responsibility for the content ot all automatically retransmitted signals be placed on the originating station. The petition, authored by Tom Blackwell N5GAR of Dallas, Texas, was designated RM-7649. It calls for a modification of Part 97, adding to Section 97.205 a section (g).

The licensee of the repeating station, whether analog or digital, would hold only a secondary responsibility for the re-transmission. Basically, he would be held responsible only to the extent that it was humanly feasible for him to intercept and censor the violation. Conversely, the user breaking the rules of the Amateur Radio Service would be the one to suffer the most severe consequences of the violation.

Earlier, the ARRL had also submitted a proposal to the FCC on this matter, but it was turned down. Blackwell feels that his petition may be successful because it calls for some measure of shared responsibility. The ARRL proposal, he said, regarded the originator solely responsible for his message.

Last January, as reported in the April "QRX," a number of packet BBS operators were fined $300, and others were cited for allowing the re-transmission of an anti-war message urging users to call a 900 number. The message did not mention the $10 fee that would be charged to the caller's phone bill. The sysops of the packet BBS stations have responded to the allegations of impropriety, but the matter is still on hold. They don't know if they will be exonerated or penalized further.

Jim Dearras WA4ONG, one of the hams cited, says, "I believe it [RM-7649] will go a long way in taking care of the problem." He pointed out, however, that "primary" and "secondary" responsibilities ought to be better defined. He added, "I am also concerned that a lot of hams do not seem to understand what has really happened. They don't see the implication as going beyond the packet BBS systems having to screen messages. They don't realize that this can be applied to digipeaters and voice repeaters!"

N5GAR said that he wrote his rules change petition to include both analog and digital modes, so that separate regulations would not be necessary. From No. 597 of the *Westlink Report.*

Balloon Experiments

Look for a student balloon experiment which will be launched at 10:00 a.m. EDT on April 27 from the U.S. Naval Academy in Annapolis, Maryland. The balloon will take a 2m FM transmitter (144.34 MHz) up to about 80,000 feet. Telemetry will consist of a CW ID

Photo A. WB4APR atop the 40-foot tracking dish at the U.S. Naval Academy.

(W3ADO Balloon) and a series of tones indicating inside/outside temperature and altitude. Anyone within 400 miles may hear the signal. They'll be using a 40-foot diameter dish to track the payload as it drifts along. See Photo A. Contact Bob Bruninga WB4APR at the Aerospace Dept., U.S. Naval Academy, Annapolis MD 21402, or call (301) 267-4380.

Spring balloon launch schedule:

April 13 at 7:30 a.m. CDT, Franklin IN (WB9IHS). Live camera ATV on 439.25 MHz. 2m FM on 144.34 MHz. 10m CW on 28.321 MHZ. HF nets on 3.871 and 28.331 MHz. Contact Chuck Crist WB9IHS at 6455 S. Madison Ave., Indianapolis IN.

Mid-April, Hillsboro WI (WB9SBD). Two meter repeater. Input of 144.48 MHz and output on 147.48 MHz. HF net on 7.155 MHz. Contact Joe WB9SBD, Rt.1 Box 235A, Hillsboro WI 54634.

May 4 at 9:30 a.m. MDT, Denver CO (AAØP). Live camera ATV on 426.25 MHz. 2m FM with voice telemetry on 144.34 MHz. 10m CW on 28.8 MHz. HF nets on 7.232 and 28.332 MHz. Sponsored by Edge of Space Sciences, Inc. Contact Jack Crabtree AAØP at 4327 Bellewood Dr., Littleton CO 80123.

May 11 at 9:00 a.m. CDT, Houston TX (WB5HLZ). Live camera ATV on 439.25 MHz. 2m FM packet and CW telemetry on 147.435 MHz. 10m CW on 28.322 MHz (K7IRK). HF nets on 7.155 and 28.332 MHz. Contact Burns Cleland WB5HLZ at 5106 Elm St., Houston TX 77081.

May 18 (morning), Whiteville NC (KC4WDW). Students at Southern Community College plan to launch a TV camera into space. See the ATV column in this issue for details.

June 15 (morning), Mojave Desert (W6BHZ). Student members of the Society of Women Engineers (SWE) at Cal Poly University in San Luis Obispo, California, plan to fly an atmospheric sampling experiment up to 80,000 feet on a large balloon. Telemetry downlink will be on 2m FM with live camera ATV on 434 MHz. Write to the Cal Poly Amateur Radio Club, UU Box 53, Cal Poly University, San Luis Obispo CA 93407 (attn: David Fichou KB6OEN).

June 29 at 9:30 a.m. EDT, Dayton OH (W8BI). Live camera ATV on 439.25 MHz. 2m FM with voice ID on 144.34 MHz. Twenty meter CW on 14.035 MHz using a Ramsey QRP-20 kit. HF net on 7.232 MHz. Contact Dayton ARA W8BI (DARA), P.O. Box 44, Dayton OH 45401-0044. *De Bill Brown WB8ELK, 73 editor.*

SWLing for News

Over the past few months, the sale of shortwave receivers has gone up 500%. Every country is selective about the news it broadcasts, and every country broadcasts some amount of propaganda, or material intentionally slanted to some degree, for its purposes. Many people have turned to shortwave to get the latest news faster, and also to compare reports of the same events.

Israel at 9435 (also at 7465 and 11605) kHz gives you right up-to-the-minute reports at 7, 8, 9, and 11 p.m. EDT. The BBC in London reports news about world events that you may not hear in the U.S.A. Listen on 5975, 6175, 7325, and 9915 kHz. A station in Dubai seems relatively unbiased; listen for it at 11 a.m. EDT on 11795, 13675, 15320, 15400, 21605, and 21675; and at 10:30 p.m. on 13675, 15400, and 15435 kHz. At 7 p.m. EDT, you can hear Moscow on 15205 or 15330; or at 8:30 p.m. on 7400, 9750, 15180, and 1770 kHz. Budapest, Hungary, is on 9835 (no time given) kHz. Iraq has been heard on 11990 or 9022 kHz in various languages. Kuwait was on 11990 (using a Saudi station?). Syria tells their side on 9950 and 12085 between 3:05 and 5:10 p.m. These are only a few of the many, many broadcasts on the air. *Frequencies listed are from* B-N-T Bulletin, *Vol. 19, Issue 3.*

Scanner Law Inquiry

Early this year, the ARRL submitted a request to the FCC, now known as Docket 91-36, that it pre-empt licensed amateurs from local scanner laws. State and local laws may prohibit the possession of ham radios—even by hams—if these radios also cover po-

QRX . . .

Tabitha Carty N1IEQ is a member of the NSRA home repeater on 146.88.

lice or other public safety frequencies deemed illegal to listen to.

Laws vary from state to state. New Jersey requires police-issued shortwave radio permits; Kentucky law authorizes officials to seize and destroy any radio equipment capable of receiving police signals; a Michigan statute exempts licensed amateurs—except for Novices and Technicians!

The ARRL pointed out that most 2m transceivers receive a range of frequencies between 139–174 MHz, which includes many public safety frequencies. The League believes that regulation is solely a federal function, and should not be left to the states. However, three of the five FCC commissioners studying the proposal have already said that they don't want to pre-empt local laws; instead, they want to know how *existing* ham transceivers and scanners could be modified to remove any capability to receive public safety radio frequencies. Under this proposal, new scanners and ham gear would have to be designed to *skip* public safety bands!

The FCC is also trying to figure out if there should be an exemption for General Mobile Radio Service licensees and equipment. Many hams, agencies, and groups use the 460 MHz GMRS, one of the Part 95 personal radio services. Then there is the Association of North American Radio Clubs, representing unlicensed shortwave listeners. It has asked for a general pre-emption for licensees and non-licensees alike.

The idea that owners of existing equipment might be required by the FCC to delete frequencies, and that newly manufactured receivers would be designed without the ability to pick up police, fire, and medical communications, is an unprecedented idea. *TNX* W5YI Report, *Vol. 13, Issue #5.*

What Counts

Tabitha Carty N1IEQ, a 13-year-old General class licensee, has been a ham for almost a year. She and her father, Joe KA1EXZ, do a lot of ATV demos at radio clubs and schools. The last demo was for an audio/video class at the Danvers High School. She is also a member of the NSRA home repeater on 146.88.

Tabitha is a student at Middle School West in Salem, Massachusetts. She holds an A-B average, and is being considered for the National Honor Society.

"I'm jealous of the kids with ham radio clubs in their schools," she writes. "Kids at my school think I'm nuts (hi, hi). I like ATV and ham radio, and that's all that counts." *TNX Tabitha N1IEQ, for responding to the request for information.*

Drake is Back!

R.L. Drake is back with a new shortwave receiver—the R8. From the early '50s to the early '80s, Drake offered a wide array of shortwave and ham equipment. For about the past eight years, it has concentrated its resources on its satellite receiver business.

The new shortwave receiver, called the R8, operates in the AM, LSB, USB, CW, RTTY, and narrowband FM modes, and covers from 100 kHz to 30 MHz. With an optional module, the R8 can also cover fire, police, public service broadcasts, and additional amateur bands in VHF (35–55 MHz and 108–174 MHz).

For more information, contact the R.L. Drake Company, P.O. Box 112, Miamisburg OH 45342.

Radio Video

"More Than Radios" highlights the importance of bringing others into the hobby. This 28-minute video was created and produced by Zman Productions, which is owned by Chuck KE7SA and Dixie N7OYY Zappala of Bothell, Washington. It was filmed in towns throughout Washington State.

"More Than Radios" video tapes are free, but there is only a limited number of them. For availability, contact ICOM America, Inc., 2380 116th Avenue N.E., Bellevue WA 98004. A tape must be ordered on ham club letterhead stationery. *TNX* Digital Digest, *Vol. 4, No. 1, and ICOM.*

Novice/Tech 80M Change

The Novice/Tech subband on 80 meters has been moved down to 3675–3725 kHz. The former privileges were from 3700–3750. If you're studying for a license, be sure to make this change in your books. If you have a frequency and mode allocations chart, you might want to note this change on it, too. *TNX* B-N-T Bulletin, *Vol. 19, Issue 3.*

Number One Ham

Ten-year-old James Catalano KC4SZT is the first of four Cub Scouts in Webelos Den 1 of Pack 1189 to pass his Novice exam. Now he is studying for his Technician ticket. He has been operating mostly 10 meters, and he has already confirmed DX QSOs with countries as far away as Australia.

Like many boys his age, he enjoys playing video games at home on TV. But he also enjoys the martial arts and playing the piano. He has recently earned his orange belt in Tae-Kwon-Do. *TNX Denis Catalano.*

James Catalano KC4SZT, a Cub Scout in Webelos Den 1 of Pack 1189, has his Novice ticket.

The Copperhead Keyer Paddle

The perfect touch!

by Charles D. Rakes KI5AZ

How many times have you wanted to try your hand at sending CW with an iambic keyer paddle, but didn't want to spend Mom's grocery money just to find out if it's really your cup of tea? Or maybe because you're just plain tired of trying to keep your mechanical monster adjusted? Or because you're still looking for that spring that took off like a ballistic missile? Whatever your reasons, you could consider building the "Copperhead Keyer," and enjoy the serenity of a nonmoving, nonmechanical, no-nonsense, electronic touch-activated keyer!

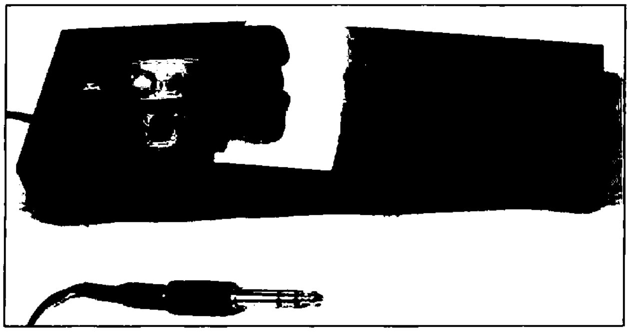

Photo A. The Copperhead Keyer—an ingenious alternative.

The Copperhead Keyer was especially designed for the home project builder who can take advantage of a few simple skills and fabricate a useful piece of equipment for a fraction of the cost of a similar commercial item. If you are a good parts scrounger—and what seasoned ham isn't?—you probably can build your own version for less than ten bucks. You can also order a kit (see the Parts List).

The paddles will operate with most commercial and home-constructed electronic keyer circuits using the Curtis chip, including the built-in versions in many current transceivers.

How the Keyer Works

Take a look at the keyer's schematic diagram in Figure 1, and you'll see just how easily electronics can replace a mechanical device. Also notice that an on/off switch isn't used or required because the standby current is so minuscule. The battery could survive in standby for its normal shelf life.

A single 4093 CMOS quad 2-input NAND Schmitt trigger IC and two 2N3904 transistors control and direct the circuit's electron flow. The two unused NAND gates are electrically stabilized by tethering their gates to circuit ground. The keyed output is fed through a mini or standard ¼-inch stereo phone plug to mate up with the majority of electronic keyers.

The "dit" (left) paddle is connected to the input of gate "A" through a 100k resistor, and back to battery positive through four series 10 megohm resistors. The very small current flow through the 40 meg resistor string holds the input high. In standby the gate's output, pin #3, is low. When the paddle is bridged, through your skin resistance, to circuit ground, the gate's output goes positive, turning Q1 on.

Q1's collector switches any positive load connected to the tip of the phone plug to ground, holding it there until the ground bridge is broken at the paddle. The "dah" paddle circuit operates in a like manner, with Q2 doing the output switching. The inputs of both gates are RF-bypassed with a 39 pF capacitor.

Bnilding Your Own Copperhead Keyer

The paddle's physical configuration can be just about anything you desire, or you can duplicate my model as shown in the figures. You can bread-board the circuit, or use perf-board. For a neat package, follow the PC board layout. If you do the breadboard method be sure to use an IC socket. No matter what scheme you follow, be sure to take special care in handling and installing the CMOS chip.

Woodchucking: See Figures 3 and 4. The keyer's base is shaped out of a hardwood block 3" x 8½" x 1¼", to match the drawings in Figure 2. A 2½" x 2¼" x 1" cavity is

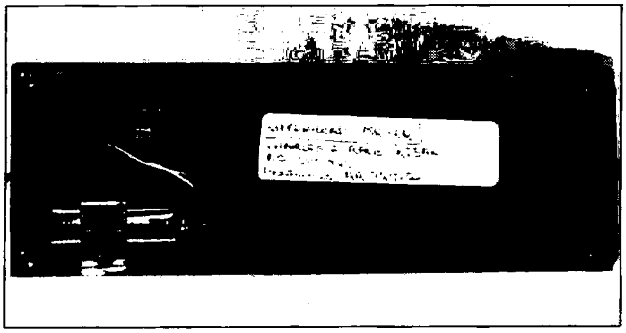

Photo B. The circuit is mounted in a compartment underneath the wooden housing.

Parts List for the Copperhead

B1	9 volt transistor battery
C1,C2	39 pF ceramic disc cap
C3	0.1 µF ceramic disc cap
IC-1	4093 quad 2-input NAND Schmitt trigger
Q1,Q2	2N3904 NPN transistors
R1,R2	100k, ¼ watt resistors
R3-R10	10 megohm resistors
R11,R12	4.7k resistors
Phone plug	stereo mini or standard, ¼-inch plug

Misc.: Hardwood material, circuit board material, battery snap, battery holder, nylon hardware, solder lugs, wire, solder, etc.

You can obtain a complete kit of parts, including a shaped base and spacer ready for stain or paint, paddles, hardware, circuit board, and all components postpaid for $27.95 from the author at Krystal Kits, PO Box 445, Bentonville AR 72712.

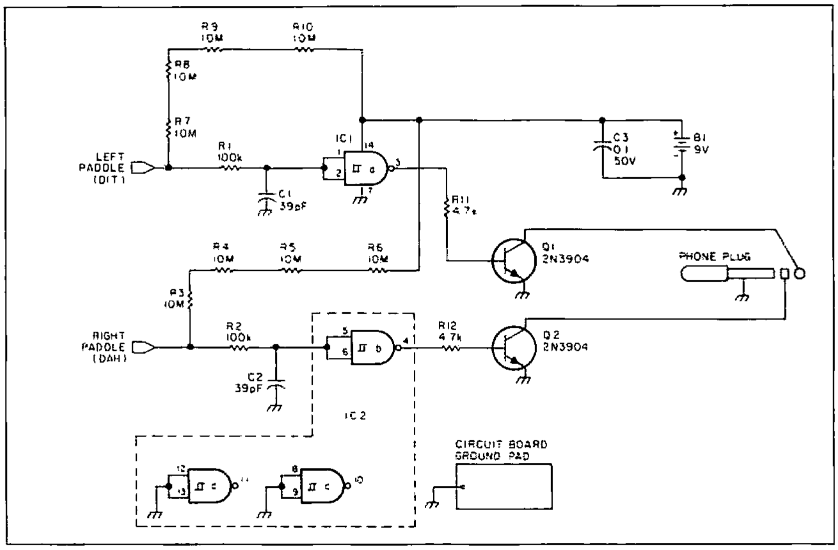

Figure 1. Schematic for the Copperhead Keyer circuit.

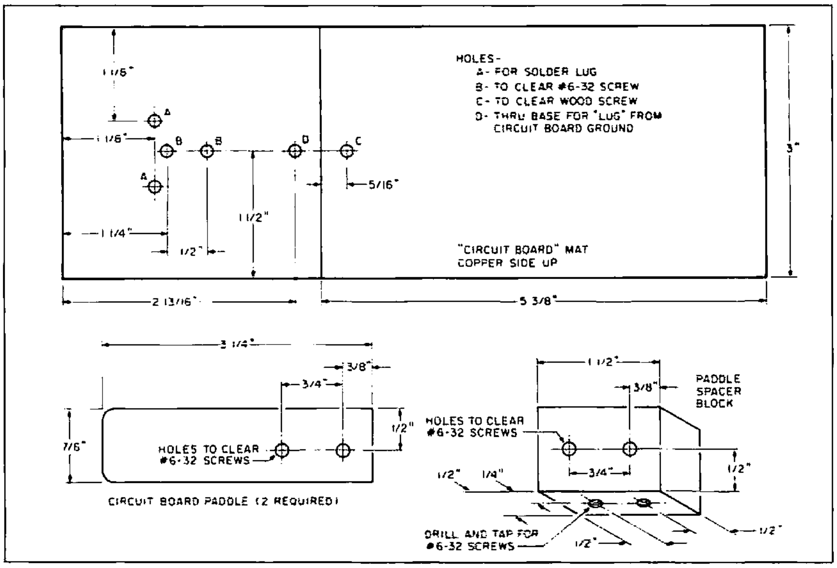

Figure 3. Plate dimensions.

carved from the base to hold the circuit board and battery.

A paddle spacer is cut to the dimensions, as shown in Figure 2, from the same hardwood material. The two paddles are cut from circuit board material to the size and shape shown in Figure 3. Two holes are drilled in each paddle to match up with the two holes in the spacer block, and the corners of one end of each of the paddles is rounded with a file or belt sander. The edges are smoothed with a fine grit sandpaper.

After the above is accomplished, you can drill the paddle mounting holes through the side of the spacer block, as shown, and then drill two holes in the bottom of the spacer. Thread each for a 6-32 metal screw. Drill four holes in the base, and mount the spacer board in place with two 5/8-inch 6-32 screws.

The grounding board, a section of circuit board 5⅜" x 3", is mounted to the keyer's base with glue and a single wood screw. A long solder lug extends from the wood screw through a hole in the base (see photo of completed keyer) to the cavity where it connects to circuit ground.

The paddles are mounted to the spacer with nylon 6-32 screws and nuts. A long solder lug on each paddle is secured by the nylon hardware and extends through the base connecting to the circuit as shown in Figure 1, the schematic.

Figure 4 shows the component side of the circuit board and parts placement. Mount the parts as shown and solder them in place. Then connect the paddles, grounding pad, battery snap, and output plug wires to the circuit board.

Mount the circuit board to the inside of the cavity with a ¼" plastic spacer and wood screw. The battery is kept in place with an L-bracket made from a spring steel, 9 volt battery holder, and is mounted to the edge of the cavity with a wood screw.

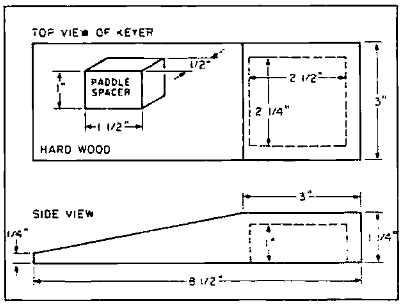

Figure 2. Dimensions for the wooden housing.

Checking Out the Keyer

With a battery in place, take a VOM in the RX-1 position and connect the positive lead (don't rely on red to mean positive, check it out) of the meter to the tip of the keyer's output plug and the meter's negative lead to the common sleeve on the plug. Position your wrist on the grounding pad and touch the "dit" (left) paddle. The meter should go from infinite resistance to near zero. To check the "dah" (right) paddle, first connect the positive meter lead to the ring on the phone plug. Next, with the negative still attached to the sleeve, touch the right paddle; the meter should drop to near zero ohms. If so, your copperhead keyer is ready for service.

Charles D. Rakes KI5AZ, P.O. Box 445, Bentonville AR 72712.

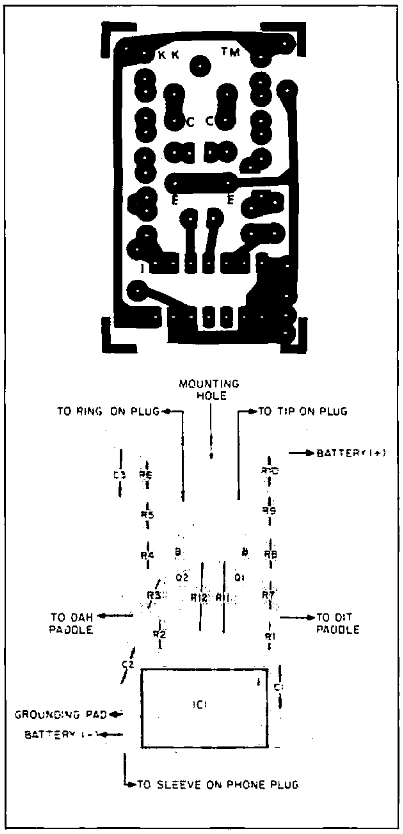

Figure 4. (a) PC board foil pattern. (b). Component placement.

The Handy Inductance Bridge

For measuring small coils.

by J. Frank Brumbaugh KB4ZGC

Hams who home-brew antenna tuners, VFOs, QRP transmitters, and receivers are usually faced with determining the values of small inductances. While there are expensive digital and analog instruments available commercially, their cost and capabilities usually exceed the budget and actual needs of the average ham. Even most of the inductance measuring devices described in the ham literature seem overly complex, and often require hard-to-find component parts. The instrument described here is a simple, inexpensive but very useful gadget for quickly measuring the inductance of small coils.

Description

The circuit is illustrated in the figure. A Pierce crystal oscillator is isolated from the bridge circuit by an emitter follower which applies approximately 2 volts rms (root-mean-square amplitude) at the crystal frequency across the bridge.

The unknown inductance is connected in series with the bridge variable capacitor, which is then tuned to balance the bridge, as indicated on the center-zero microammeter. The inductance of the unknown is indicated on the calibrated dial.

This instrument, which operates at a frequency of 5 MHz, is capable of measuring from about 1 µH to 30 µH. This range encompases the vast majority of those small coils that need to be measured accurately.

Theory of Operation

The Pierce crystal oscillator, and the emitter follower, together comprise the generator that provides operating voltage to the bridge. The bridge is the heart of the instrument. L2 and C6 in series form the two fixed, known legs of the bridge.

The values of 22 µH and 47 pF were chosen to be series resonant at the 5 MHz crystal frequency. Because of the phase relationship between voltage and current in a series circuit, there is approximately 3.6 volts rms of RF at the junction of L2 and C6 when approximately 2.1 volts rms of RF is applied across the bridge, measured to ground. This allows greater voltage variation across the null detector formed by the center-zero meter and back-to-back diodes, which makes the null indication easier to determine accurately.

The back-to-back diodes, D1 and D2, are required both to rectify the RF voltage and to allow the center-zero meter needle to swing to both sides of center so an accurate null can be obtained. Although the diode conduction "knees" will appear at the center zero null, slightly broadening it, this does not adversely affect bridge accuracy.

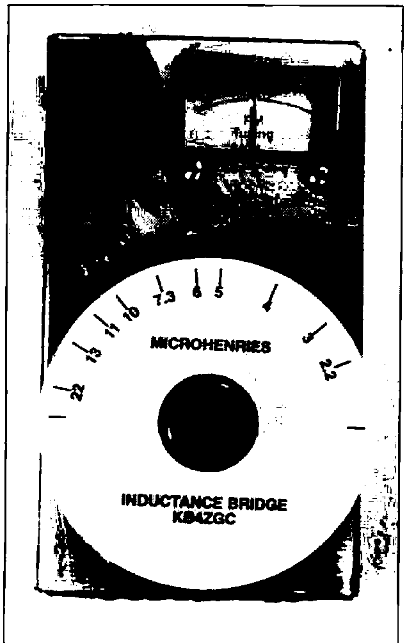

Photo A. The Inductance Bridge.

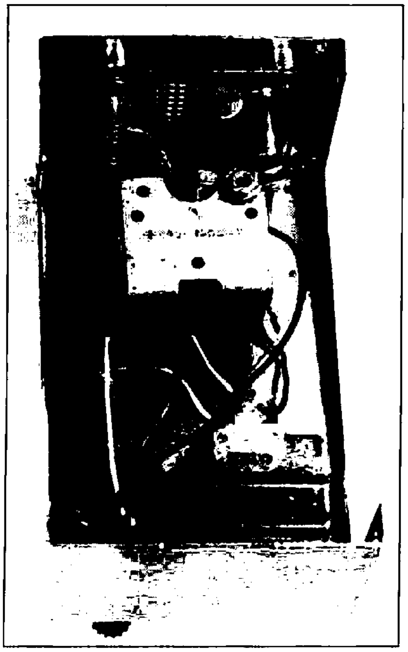

Photo B. Internal view of the bridge.

You can use crystals of other than 5 MHz, but if you do, you *must* change the values of both L2 and C6 so they are series resonant at the chosen crystal frequency.

Bridge tuning capacitor C7 is a nominal 365 pF variable capacitor removed from an ancient broadcast receiver. With this value capacitor and a bridge frequency of 5 MHz, inductances from about 1 µH to 30 µH can be measured accurately.

Using a smaller or larger capacitor and retaining the 5 MHz bridge frequency will shift the range over which inductances can be measured. Using a different frequency crystal (and changing the values of L2 and C6 appropriately) will also shift the range of measurement. However, regardless of the bridge frequency, the minimum capacitance of C7, plus stray circuit capacity, establishes the minimum measureable inductance.

Because the bridge frequency must be stable for accurate measurement of inductances, a crystal oscillator must be used. Any crystal oscillator circuit can be used—but the Pierce is the simplest and most foolproof. Remember, though, if you use a different crystal frequency, you may have to use different values of feedback capacitors C1 and C3.

This instrument is powered by a 9 volt battery to make it portable. You may use almost any DC voltage between about 6 and 15 volts. Using a 9 volt battery, total current drain is less than 15 mA.

An LED in a "free current" circuit is included as a power-on indicator. Because total operating current flows through the LED, it does not increase the load on the battery. Also, the LED will grow dimmer as the battery is depleted through use, alerting you to replace the battery.

The bridge is designed so that its tuning capacitor, C7, has its rotor plates grounded, simplifying construction and eliminating hand capacity from interfering with the accuracy of measurement.

Construction

The Inductance Bridge must be constructed in a shielded enclosure. An aluminum box, or an enclosure made from double sided PC-board material, may be used.

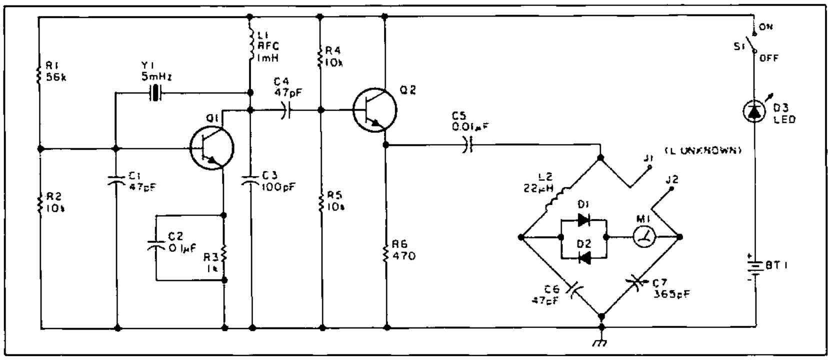

Figure 1. Schematic for the inductance bridge.

All of the circuitry can be constructed on a small piece of perf board, or a printed circuit board (such as Radio Shack 276-150). Keep RF wiring short and direct.

Install the binding posts J1 and J2 at one end of the enclosure, as far as possible from bridge tuning capacitor C7. *You want your fingers to be as far away as possible from the field around the unknown inductance being measured.*

Use stiff solid wire to connect C7 to J2, and from J1 to the junction of C5 and L2.

The 9 volt battery can be held in a clamp made for that purpose, or attached to the inside of the enclosure with a strip of Velcros™.

Parts Used

All parts used in this instrument, except the enclosure, came from my junk box (yes, I have a DEEP junk box, having been a ham since 1949). I used an aluminum box approximately 2" x 3" x 4" which I got for $1.50 at a hamfest.

Q1 and Q2 can be any small signal NPN transistors, such as 2N3904, 2N4124, 2N2222, etc.

L1 is an RF choke. Anything from about 390 µH to 2.5 mH can be used. The value is somewhat dependent upon the crystal frequency. Use a 2.5 mH choke at 1 MHz, or 390 µH at 10 MHz, for instance. The actual value is not of great importance as long as sufficient RF voltage is applied to the bridge.

L2 is a 22 µH RF choke; it's an important part of the bridge when a 5 MHz crystal oscillator is used to power it, as described earlier. Any 22 µH coil could be used here if its value is known accurately.

Meter M1 is a surplus FM tuning meter, center-zero, with a 200 µA movement. You can use any similar meter that's sensitive; 50-0-50 µA or 100-0-100 µA movements are suitable. Similar meters are available from Micro-Mart Inc., 508 Central Avenue, Westfield NJ 07090, and other mail-order dealers, for about $2.00. *[Ed. Note: A suitable meter is also available from Hosfelt Electronics, Inc., (800) 624-6464; part# MHE 5, the 100-0-100 µA meter.]* If you cannot locate a center-zero meter, there are numerous small edgewise and standard 100 or 200 µA meters which, with care, can usually be changed to indicate center zero. Carefully remove the cellophane tape holding the meter together and remove the front section to allow access to the movement. *Very carefully* push the long metal lever extending from the movement to one side while watching the meter needle. This will often allow movement of the needle to rest at the center of its scale. You may have to use needle nose pliers or the end of a screwdriver to move this lever. Use extreme care so you won't deform the lever or break the tiny spring attached to it.

CAUTION: These small edgewise meters, often calibrated in TV channel numbers, do NOT have a zero-adjust: DO NOT ATTEMPT TO USE A JEWELER'S SCREWDRIVER ON THE TINY SCREW AT THE CENTER OF THE MOVEMENT! This is a pivot screw, and tightening or loosening it may damage or destroy the meter movement.

Not all such meters can be modified to put the needle at the center, but most can be. Even if it is impossible to move the meter needle to the center of its range, if it can be moved a half-inch or so, it can be used, marking the meter scale at the new needle position as "zero."

Bridge tuning capacitor C7 may be difficult to locate if you do not have one in your junk box. Your best bet is to check with local hams and radio-TV repair shops. If this doesn't produce a usable capacitor, any hamfest should offer a wide selection. You may also find a suitable tuning capacitor from Fair Radio Sales, PO Box 1105, Lima OH 45802, (419) 227-6573 or from Antique Electronic Supply, (602) 820-5411; part# CV-230.

You can obtain crystal Y1, a 5 MHz surplus microprocessor crystal, from most mail-order dealers, as they offer a wide selection of these crystals of various frequencies. A 5 MHz HC-25 crystal is $1.25 from BCD Electro, PO Box 450207, Grand Prairie TX 75045-0207. They stock inexpensive crystals in the range of 33 kHz to 143 MHz, as do many other mail-order dealers.

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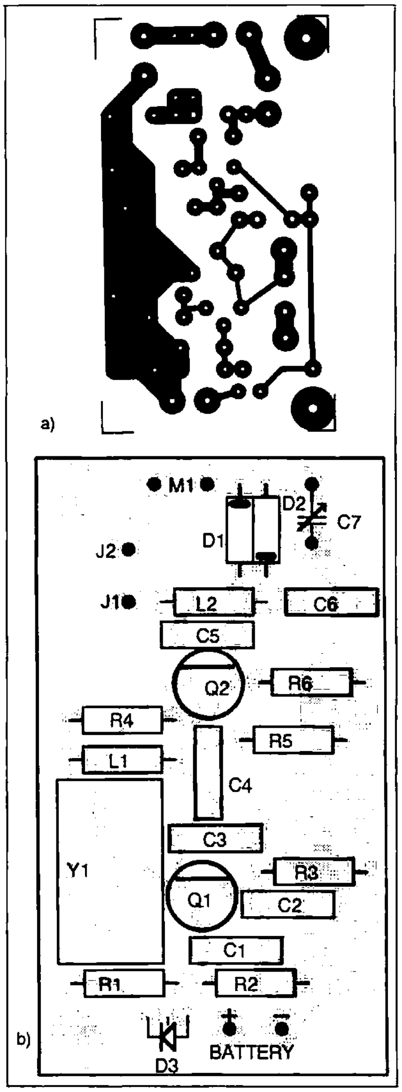

Figure 2(a). PC board foil pattern. (b). Parts placement.

Parts List

BT-1	9-V battery
C1,C4,C6	47 pF silver-mica capacitor
C2	0.1 µF disc capacitor
C3	100 pF silver-mica capacitor
C5	0.01 µF disc capacitor
C7	365 pF variable tuning capacitor (see text)
D1,D2	1N914, 1N4148, 1N34A, 1N60, etc.
D3	LED
J1,J2	Binding post
L1	RF choke, 1 mH (see text)
L2	22 µH RF choke
M1	100–0–100 µA center-zero meter
R1	56k, ¼W, 5% resistor
R2,R4,R5	10k, ¼W, 5% resistor
R3	1k, ¼W, 5% resistor
R6	470 ohm, ¼W, 5% resistor
S1	SPST toggle or slide switch

Note: A blank PC board is available from FAR Circuits, 18N640 Field Court, Dundee IL 60118 for $4 +$1.50 postage. Please indicate this article when ordering.

The Mini-Keyer

A smaller and newer version of an old friend.

by Klaus Spies WB9YBM

Ten years ago, for a high school project, I built my first keyer using a schematic from Howard Berlin's *555 Timer Application Sourcebook, With Experiments*. When I upgraded to General, the keyer was a bit sensitive to 1 kW (the audio oscillator made a chirpy noise), but the unit served me well for many years. There were ample nooks and crannies behind which to hide this large box, but there came a time when I felt an upgrade was due, for several reasons.

First, most (if not all) modern rigs have a built-in sidetone oscillator, so I no longer needed one built into the keyer. Deleting this part of the circuit, as well as the speaker, made me curious to see how small the keyer could actually be made—not because I needed more room on my table (compared to my 2 kW amp and TR-7, even the original circuit was small), but to keep up with the modern trend of compactness and the design challenge it entailed. The keyer could very easily be powered from a regulator, so an unregulated, dirty and cheap wall transformer ($7 at Tri-State Electronics in Mount Prospect, Illinois, or about $9 at any Radio Shack) can be hidden away under the hamshack table, on the same bus the transceiver plugs into.

Although the majority of hams have a 12 volt power supply available in their shack to power their mobile VHF/UHF transceivers, I wanted to design in as much independence as possible into this keyer. If you want to use this keyer for Field Day, for example, it can be plugged into the same 110 volt generator powering the HF rigs, so there's no need to lug along a 12 volt supply. The only other option would be to power the circuit with a 9 volt battery, but who wants one of those things running out of juice in the middle of a QSO?

I also made a minor circuit modification. The dual NOR gates (the second acting as an inverter) were replaced with a single OR gate. Although the typical OR gate IC available on the market has plenty of gates to spare (there are four per package), it seemed to be poor engineering practice to use gates just because they were there. See Figure 1. A 6 volt relay can be driven by the 2N2222A transistor, if additional isolation is required or desired between the keyer and the HF rig.

For final assembly, I used a deep-drawn

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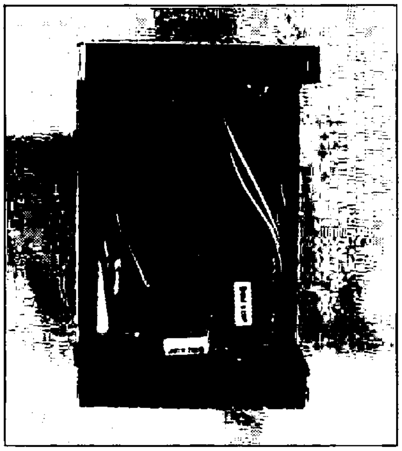

Photo A. *The mini-keyer mounted in its case.*

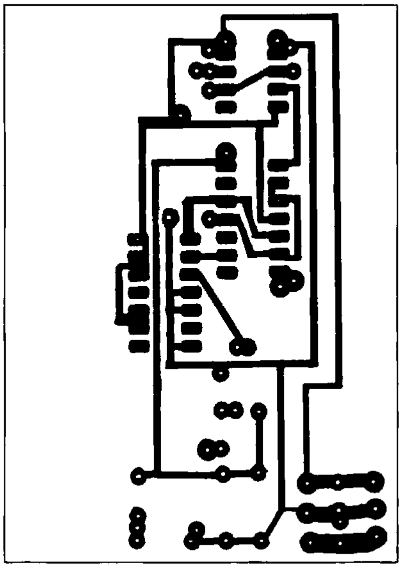

Figure 2. PC board foil pattern.

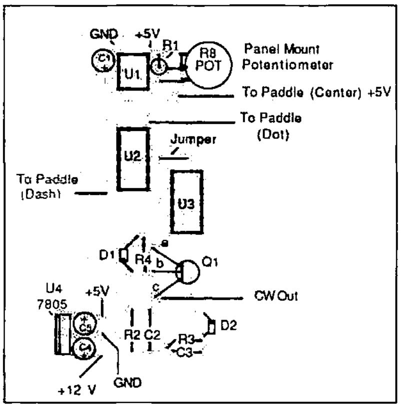

Figure 3. Parts placement.

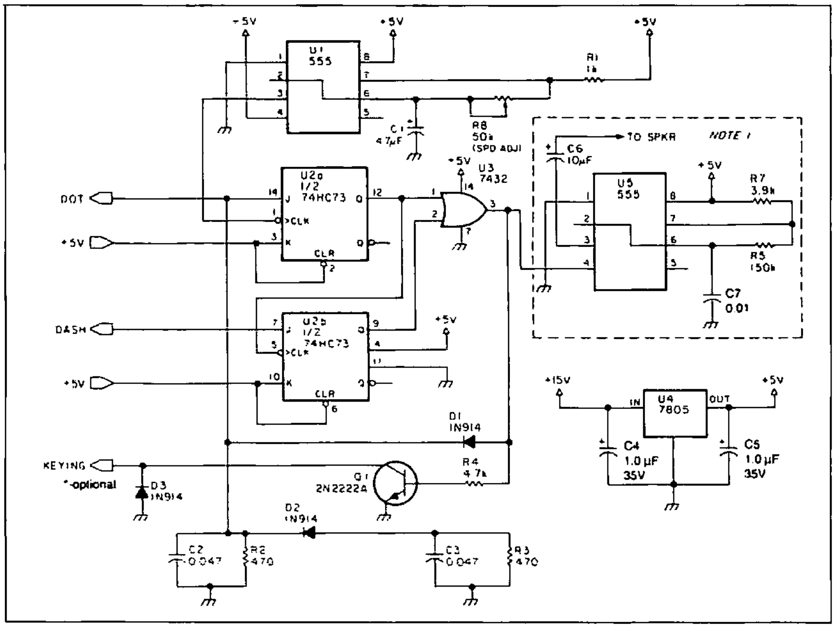

Figure 1. Schematic diagram of the keyer (modified from the original keyer in Howard Berlin's 555 Timer Application Sourcebook, With Experiments.

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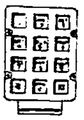

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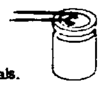

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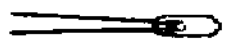

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The Mini Keyer

Continued from page 14

aluminum box, put bypass capacitors as well as ferrite beads on all of the incoming and outgoing leads, and kept holes in the box to the absolute minimum.

I have used this new keyer for several months, and have found no problems in operation. ■

Contact Klaus Spies WB9YBM at 8502 N. Oketo Ave., Niles IL 60648-2006.

Parts Sources

Tri-State Electronic Corp.
200 W. N.W. Highway
Mount Prospect IL 60056
(708) 255-0600

Jameco Electronics
1355 Shoreway Rd.
Belmont CA 94002
(415) 592-8097

Parts List

U1	555 IC timer
U2	74HC73 IC
U3	74HC32 IC
U4	7805 voltage regulator
Q1	2N2222A transistor
D1,D2	1N914 diode
R1	1k resistor, ¼ W
R2,R3	470 ohm resistor, ¼ W
R4	4.7k resistor, ¼ W
R5	50k potentiometer
C1	4.7 µF/35V electrolytic capacitor
C2,C3	0.047 µF ceramic capacitor
C4,C5	1.0 µF/35V electrolytic capacitor

Optional side-tone generator
(enclosed by dotted line in Figure 1)

U5	555 IC timer
R6	150k resistor, ¼ W
R7	3.9k resistor, ¼ W
C6	10 µF/35V electrolytic capacitor
C7	0.01 µF ceramic capacitor
SPKR	8 ohm speaker

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The Handy Inductance Bridge

Continued from page 12

All other components are items most hams already have on hand, or which can be found at Radio Shack. An excellent source for numerous small parts, components, and semiconductors/ICs is: Short Circuits, PO Box 285, Barnegat NJ 08005. Send them a postcard requesting their free catalog.

Calibration

The simplest way to calibrate this instrument is by connecting known values of inductance between J1 and J2, tuning C7 for a null, and marking the value on the dial. The circle cut from a panel to make a hole for a meter makes an excellent dial plate which can be epoxied to the tuning knob. You also might merely use a pointer knob and make calibration marks on the panel.

Most mail-order dealers carry a wide selection of small value RF chokes suitable for calibration. These are generally ±10% tolerance, sufficiently accurate for most purposes, and come in values from below 1 µH to around 3 mH. A few small RF chokes used singly, and in series and parallel, will provide numerous calibration points over the range of this instrument. Generally these chokes cost between 20¢ and 60¢ each, depending upon value.

Operation

With the instrument turned off, connect the unknown coil between the binding posts, J1 and J2. Rotate the bridge tuning capacitor C7 so the plates are fully closed—at the low inductance end of its range.

Turn the instrument on and note the meter needle swings to one side. Adjust C7 while watching the meter needle until the meter indicates zero. Read the value of the unknown inductance off the calibrated dial.

NOTE: *In some instances, when you tune C7 over its entire range, the needle may cross zero twice. The first zero indication when tuning from the low inductance range is the correct one.*

Assuming the bridge to be turned on and operating properly, if the meter needle does not move off center when C7 is tuned through its range, then either the coil being measured is open, or it is not properly connected to the binding posts.

If the meter swings to one side of zero and will not reach center as C7 is tuned through its entire range, then the inductance of the coil being measured is outside the range of the bridge—it's either too large or too small.

Cost

If all new (surplus) parts must be purchased, this Inductance Bridge should cost no more than ten dollars. This can be reduced by what you have on hand, can trade for, or get from other hams or at hamfests. ■

You may write to J. Frank Brumbaugh KB4ZGC at 82 Liddell Street, Buffalo NY 14212-1824.

Covert Hamming

A design for your next secret mission.

by Eldon Ryan K6BRP

Several years ago a major manufacturer of two-way radios designed a handheld exclusively for those with the need for unobtrusive communication, such as the FBI.

The radio had no internal speaker, microphone, or push-to-talk button. It was a handheld that didn't need to be hand-held. It could be concealed in a coat pocket or carried by belt clip. The PTT wiring was routed down the operator's coat sleeve and activated by a push-button in the palm. The miniature microphone was pinned under the necktie or lapel of the coat. The only telltale evidence of a concealed radio was the ear piece, which resembled a hearing aid.

This rig had a price tag of nearly three hundred dollars.

For less than five dollars, you can turn your HT into a device that operates on the same principles. You can use the remaining two hundred ninety-five dollars to build the other great projects that appear in *73*.

No originality is claimed for the following project, since the idea has been around and in use for some time. Numerous good articles have appeared about how to adapt Star Sets, Radio Shack headsets, booms, and mikes to your HT.

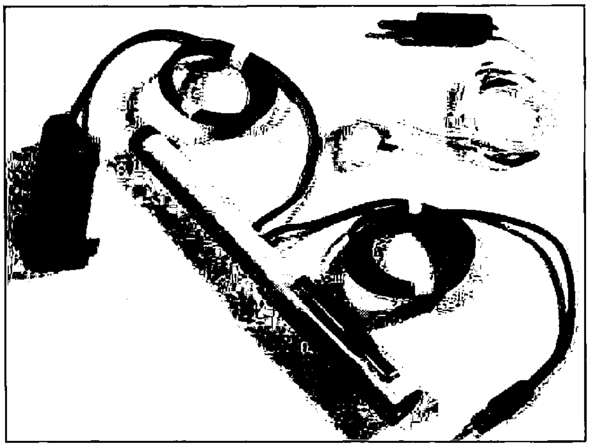


Photo A. The microphone may be concealed in a defunct pen housing. (Photo by Andy N6KAS.)

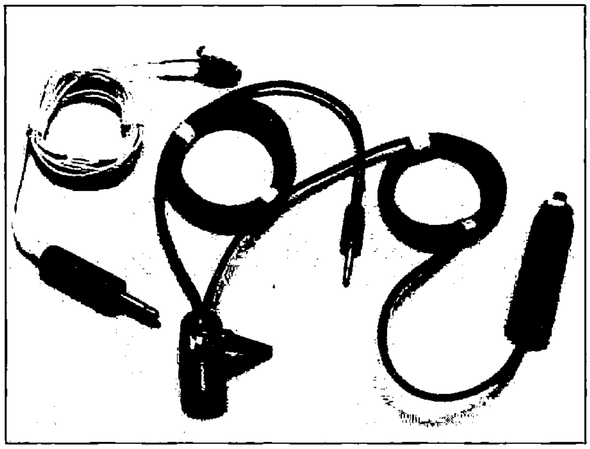


Photo B. You can also build the microphone into a phone plug housing. (Photo by Andy N6KAS.)

Let's go undercover....

First, here are two microphone design ideas: You could build it inside a defunct pen housing (see Photo A); or you could use the plastic housing from a quarter-inch phone plug (see Photo B).

The plastic "barrel" can be cut in half to reduce the size, and a mini alligator clip can be attached to the assembly with a very small self-tapping screw solidified with epoxy. The plastic barrel of a quarter-inch phone plug can also serve as a mounting for the PTT button switch (see Photo C).

Figure 1 is a schematic of an electret condenser microphone as it may appear in the operator's manual you originally received with your HT. Figure 2 is the schematic of the modified version.

Notice that the radio is keyed in series with the microphone.

A voltage is required for an electret microphone. This voltage, of course, is supplied by the radio.

It may or may not be necessary to decrease this voltage, the mike bias, but you can do it by placing a resistor of 1.5k or 2.2k ohms across the mike element. A 0.001 µF bypass capacitor may also be necessary. You can determine the correct value of the resistor by observing the deviation on a service monitor or deviation meter while speaking into the microphone. Keep in mind that you are not going to be talking directly into this microphone as you would your SPKR/MIC or the internal mike of your radio.

The microphone element can be a Radio Shack 270-090 or All Electronics Corporation MKE-2 (I recommend that you send for the All Electronics catalog. It's loaded with lots of goodies at bargain prices. See their ad in this issue).

Ignore the schematic on the back of the Radio Shack package, but DO observe polarity. The *high* side goes to the PTT button. Notice that there are no shields connected to the mike element.

The All Electronics element has

Continued on page 85

Parts List

2	24-inch lengths of shielded wire	RS 278-752
1	electret microphone element	RS 270-090
	or All Electronics Corporation	# MKE-2
1	momentary contact push button switch	RS 275-618 or equiv.
1	mike plug	RS 274-289 or RS 274-286*
2	¼" phone plugs, plastic housing	junk box
1	2.2kΩ ¼W resistor	junk box
1	0.001 µF capacitor	junk box
1	mini alligator clip	junk box

*Depending on the type of radio you have.

Note: The microphone and miscellaneous parts can be obtained from All Electronics Corp., P.O. Box 567, Van Nuys CA 91408. Telephone: (800) 826-5432.

Software for the Ham Shack, Part I

Useful ham calculations you can program yourself!

by Bill Clarke WA4BLC

The computer is commonplace in ham shacks. In fact, I would say that next to the old HF rig, it is the most common resident of the typical station. Over the next four months, I'm going to show you how to use the computer to aid you in building, repairing, modifying and designing ham equipment by doing your mathematical computations. Let's say that I am going to show you how to broaden the scope of computer usage in the shack.

Each month I'll include new computer programs. Each of these programs will consist of separate modules, or building blocks, that will become a ham radio computer system, menu driven and user friendly.

The program part for this month includes a portion of the MAIN MENU, a module for the design of antennas, and a module for measuring the physical lengths of transmission lines. Each month, as more modules are included, the MAIN MENU will grow.

Main Menu

The completed MAIN MENU will resemble this:

MAIN MENU FOR THE (your callsign)
HAM SYSTEM

1 - ANTENNA DESIGN MATH
2 - TRANSMISSION LINE MATH
3 - OHM'S LAW
4 - POWER FORMULAS
5 - EFFICIENCY FORMULA
6 - RADIO HORIZONS
7 - OHMS TO RESISTOR COLORS
8 - RESISTOR COLORS TO OHMS
9 - AIR COIL INDUCTANCE
X - FINISHED USING

ENTER YOUR SELECTION

Notice the place for "your callsign." After all, this is your system.

Module One

Antenna design is just about as basic to amateur radio as you can get. Without antennas there is no radio operation. Of course, some math is needed when designing dipoles, vees, quarter-waves, etc. In fact, math is even needed when cutting ground radials for vertical antennas. This program module asks the user to enter a frequency (in MHz), to which it then responds with the electrical wavelength for that frequency. Additional responses include all the normal fractional wavelengths (½, ¼, etc.). The dimensions for a dipole cut to that frequency are given, as are the measurements for radials.

Module Two

Many recent antenna articles call for a quarter wavelength of transmission line for one reason or another, usually as a matching transformer. As in the antenna module, the user is prompted to enter the frequency of design. The computer responds with physical lengths for quarter- and half-wavelengths of the popular coaxial transmission lines in use today. This module bases its computations on velocity factors.

About the Programs

The program modules given in this series of articles are written in BASIC. Most hobby computerists understand BASIC, and their computers understand it as well. It is a relatively universal language, usable on IBM ™, clones of them, Atari ™, Apples ™, and the Commodore ™ series of computers. It may well be, however, that some slight modification to the programs will be needed to run them on your particular machine. Although written in GW BASIC for use on a clone, I have attempted to make the programs as transportable between the various brands as possible. Program modifications are noted for the Commodore at the end of each article in the series.

Entering a Program Listing

Entering a program listing into your computer is very easy, although it calls for exacting accuracy. No mistakes can be tolerated. To err will cause a failure sooner or later. Generally sooner!

Depending on the system you have, set it up to operate on BASIC. Once ready to operate in BASIC, type in the listing as it is given. For example:

```
10 PRINT "MAIN MENU"
```

What you actually type is: 10 space PRINT space "MAIN space MENU" (the quote marks get typed also). Then you press ENTER (or the RETURN key on some machines). In other words, type exactly what you see. Be sure to type in capital letters, just like the program listings show.

That's all there is to it. Of course, there are quite a few lines to enter, so take your time and be careful. Oh yes: *In line 12, type your callsign in place of the six X's.*

After you have completed typing in all the lines, you must SAVE your work.

Alternative methods of program entry, such as WordStar in nondocument mode, are permissible.

Saving Your Work

Saving a program is very simple. Place a FORMATTED blank disk in the disk drive, then type SAVE "HAM1" (on the Commodore, type SAVE "HAM1",8) and press ENTER. HAM1 is the name we are giving to the first section of the overall HAM program.

There is a reason for saving a program before trying to use it. This will all become very clear in a few minutes.

Using the New Program

LOAD the new program by typing LOAD "HAM1" (LOAD "HAM1", 8 on the Commodore) and pressing ENTER. When the computer signals READY on the screen, type RUN and press ENTER.

The next thing you should see is the MAIN MENU for your new Ham System. It should show three selections: ANTENNA DESIGN MATH, TRANSMISSION LINE MATH, and FINISHED USING. Go ahead and put the program through its paces. Try a few frequencies for test purposes.

HINT: If the menu selections fail to respond, try locking the keyboard into upper case (caps).

Should you enter into a menu selection you don't want, press the ENTER key until a small menu appears in the lower left corner of the screen that gives you the option to press M for MAIN MENU.

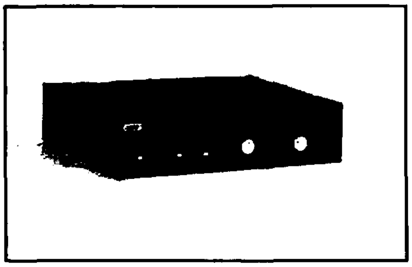
If you have an error in anything you see on the screen, such as wording, typos, or a computer failure or lockup, then reset the computer. Again LOAD the program (as before). However, instead of running it, you will LIST it. Listing shows everything you typed in from the program listing. To list: type LIST and press ENTER.

Sometimes when a program fails, it will cause the computer to halt operation completely. This is called a lock-up. The only way to get it going again is to reboot it. Rebooting usually equates to turning the computer off, then back on. This will cause a complete loss of all data and programs that were in the computer's memory. If you had not saved your program to disk, it would be gone. To get it back, in that case, you would have to re-enter it from the listing. Now you see why the program was saved before it was run. ALWAYS SAVE YOUR WORK BEFORE RUNNING IT.

While checking the listing, if you see an error, use the CURSOR keys to move the cursor to the incorrect line. Make the correction, then press ENTER. ENTER is pressed

REVOLUTIONARY

is the only word to describe this:



The NIR-10 is a Noise/QRM Reducer for SSB VOICE! It is the only device available that can reduce noise and remove heterodynes occuring in the presence of speech. What makes this possible? Real-Time Digital Signal Processing (DSP) using a 40 MHz DSP chip!

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•Includes a Bandpass Filter Mode to Enhance CW and RTTY. Forms a Variable Center Frequency Digital Filter with Selectable Bandwidth. Provides performance that analog filters can't match!

•Work More Stations: Allows Reception of Otherwise Unreadable Signals!

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NIR-10: $395; with 12V AC Adapter add $12. We pay shipping.

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Tech 1-919-790-1048
FAX 1-919-790-1456

MC/Visa. Allow 3 wks for personal checks. Add $3 for COD. NC residents add 5% sales tax.

JPS Communications, Inc.
5516 Old Wake Forest Road
P.O. Box 97757 Raleigh, NC 27609

CIRCLE 285 ON READER SERVICE CARD

HAM1 Listing

```
10 CLEAR : CLS
11 PRINT : PRINT
12 PRINT SPACE$(23);"MENU FOR THE XXXXXX HAM SYSTEM"
13 PRINT SPACE$(23);"------------------------------"
14 PRINT SPACE$(26);"1 - ANTENNA DESIGN MATH"
15 PRINT SPACE$(26);"2 - TRANSMISSION LINE MATH"
25 PRINT SPACE$(26);"X - FINISHED USING"
30 M$ = INKEY$
31 IF M$ = "1" THEN 100
32 IF M$ = "2" THEN 200
33 IF M$ = "X" THEN SYSTEM
49 GOTO 30
50 DEF FNA(A) = INT (A*100+.5)/100
51 DEF FNA(B) = INT (B*100+.5)/100
52 DEF FNA(C) = INT (C*100+.5)/100
53 DEF FNA(D) = INT (D*100+.5)/100
54 DEF FNA(E) = INT (E*100+.5)/100
55 DEF FNA(F) = INT (F*100+.5)/100
56 DEF FNA(G) = INT (G*100+.5)/100
60 DEF FNA(AA) = INT (AA*100+.5)/100
61 DEF FNA(BB) = INT (BB*100+.5)/100
62 DEF FNA(CC) = INT (CC*100+.5)/100
63 DEF FNA(DD) = INT (DD*100+.5)/100
70 RETURN
100 CLEAR : CLS
101 PRINT SPACE$(26);"ANTENNA DESIGN MATH"
102 PRINT SPACE$(20);"------------------------------"
103 PRINT : PRINT : PRINT
104 INPUT "ENTER THE FREQUENCY";Z
105 IF Z <= 0 GOTO 10
110 CLS
111 PRINT SPACE$(26);"ANTENNA DESIGN MATH"
112 PRINT SPACE$(20);"------------------------------"
113 PRINT : PRINT : PRINT
120 A = 994/Z
121 B = A*.75
122 C = A*.5
123 D = A*.25
124 E = A*.1
125 F = 234/Z
126 G = 240/Z
127 GOSUB 50
130 PRINT "DESIGN FREQ: "Z" MHZ --- DIMENSIONS IN FEET"
132 PRINT SPACE$(15);"FULL WAVE LENGTH IS: "FNA(A)
133 PRINT SPACE$(15);"3/4 WAVE LENGTH IS:  "FNA(B)
134 PRINT SPACE$(15);"1/2 WAVE LENGTH IS:  "FNA(C)
135 PRINT SPACE$(15);"1/4 WAVE LENGTH IS:  "FNA(D)
136 PRINT SPACE$(15);"1/10 WAVE LENGTH IS: "FNA(E)
137 PRINT SPACE$(15);"DIPOLE LEGS ARE:     "FNA(F)
138 PRINT SPACE$(15);"RADIALS ARE:         "FNA(G)
140 PRINT
141 PRINT "N - TRY AGAIN"
142 PRINT "M - MAIN MENU"
143 M$ = INKEY$
144 IF M$ = "N" THEN 100
145 IF M$ = "M" THEN 10
146 GOTO 143
200 CLEAR : CLS
201 PRINT SPACE$(24);"TRANSMISSION LINE MATH"
202 PRINT SPACE$(20);"------------------------------"
203 PRINT : PRINT : PRINT
204 INPUT "ENTER THE FREQUENCY";Z
205 IF Z <= 0 THEN 10
210 CLS
211 PRINT SPACE$(24);"TRANSMISSION LINE MATH"
212 PRINT SPACE$(20);"------------------------------"
220 Q = 248.5/Z
221 A = .75*Q : AA = 2*A
222 B = .66*Q : BB = 2*B
223 C = .8*Q : CC = 2*C
224 D = .79*Q : DD = 2*D
225 GOSUB 50
230 PRINT "DESIGN FREQ: "Z" MHZ --- DIMENSIONS IN FEET"
232 PRINT "1/4 WAVE"SPACE$(2);"RG8       "SPACE$(10);FNA(B)
233 PRINT SPACE$(10);"RG8A      "SPACE$(10);FNA(B)
234 PRINT SPACE$(10);"RG8 FOAM  "SPACE$(10);FNA(C)
235 PRINT SPACE$(10);"RG8X      "SPACE$(10);FNA(A)
236 PRINT SPACE$(10);"RG58      "SPACE$(10);FNA(B)
237 PRINT SPACE$(10);"RG58 FOAM "SPACE$(10);FNA(D)
238 PRINT SPACE$(10);"RG58 A/B/C"SPACE$(10);FNA(B)
239 PRINT SPACE$(10);"RG213     "SPACE$(10);FNA(B)
242 PRINT "1/2 WAVE"SPACE$(2);"RG8       "SPACE$(10);FNA(BB)
243 PRINT SPACE$(10);"RG8A      "SPACE$(10);FNA(BB)
244 PRINT SPACE$(10);"RG8 FOAM  "SPACE$(10);FNA(CC)
245 PRINT SPACE$(10);"RG8X      "SPACE$(10);FNA(AA)
246 PRINT SPACE$(10);"RG58      "SPACE$(10);FNA(BB)
247 PRINT SPACE$(10);"RG58 FOAM "SPACE$(10);FNA(DD)
248 PRINT SPACE$(10);"RG58 A/B/C"SPACE$(10);FNA(BB)
249 PRINT SPACE$(10);"RG213     "SPACE$(10);FNA(BB)
260 PRINT
261 PRINT "N - TRY AGAIN"
262 PRINT "M - MAIN MENU"
263 M$ = INKEY$
264 IF M$ = "N" THEN 200
265 IF M$ = "M" THEN 10
266 GOTO 263
```

Line Modifications for the C-64

The following commands must always be replaced as shown:

```
SPACE$(**):  must be removed.
Example: 12 PRINT "MENU FOR THE XXXXXX HAM SYSTEM"

CLS  replaced by  PRINT "[shifted]CLEAR/HOME".

CLEAR  replaced by CLR

M$ = INKEY$  replaced by  GET M$ : IF M$ = "" THEN (line number)
Example: 30 GET M$ : IF M$ = "" THEN 30

replace the word DIMENSION with SIZE
```

Other modification lines are typed as they appear below:

```
 33 IF M$ = "X" THEN END
231 PRINT "1/4 WAVE"
232 PRINT "RG8        "FNA(B)
240 PRINT "PRESS ANY KEY FOR MORE" : GOSUB 290
241 PRINT "1/2 WAVE"
242 PRINT "RG8        "FNA(BB)
290 GET Z$ : IF Z$="" THEN 290
291 PRINT "[shifted CLEAR/HOME]" : RETURN
```

Continued from p. 22

for each line that is corrected. After all corrections have been made, SAVE the program as you originally did. However, give it a new name: HAM1A. Some computers will not accept programs of the same name on a single disk. Later, after you are satisfied that all is correct with the latest saved version, go back and erase the error-ridden versions. Then re-name the good version HAM1.

Well, that's all for now. Happy typing and running. More will follow next month. *[Ed. note: This month's listing, "HAM1," can be downloaded from the 73 BBS. Phone: (603) 525-4438 (73mag SIG).]*

You may reach Bill Clarke WA4BLC at RD#2 Box 455-A, Altamont NY 12009.

You can subscribe to 73 by phone. Call 1-800-289-0388.

Two QRP Transmitters

Dust the ethers and bend the waves!

by Charles D. Rakes KI5AZ

Here's two hot little CW QRP transmitters that you can build in an evening or two, then enjoy spanning the globe in milliwatt slippers for many moons and not be out much loot to boot.

The first and more complex of the two QRP transmitters is the 80 meter "Color Burst Ether Duster." It spurts out over 1 watt with full break-in operation. Two 7400 TTL ICs and four 2N3904 transistors control the electron flow.

The second and simplest transmitter is the 40 meter "Wave Bender" that operates with one IC and two transistors, to massage the antenna with about 500 to 750 milliwatts. This transmitter requires either a manual transmit-receive switch or a separate TX and RX antenna system.

Both circuits can be tailored to operate in either the 40 or 80 meter band by changing the crystal (XTAL) and output filter.

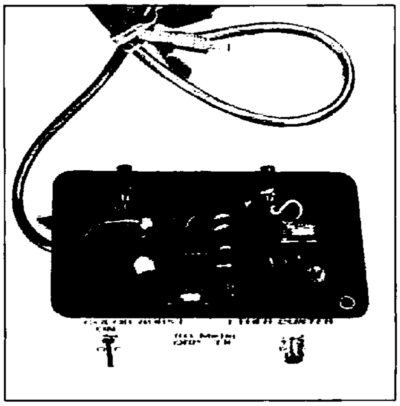

Photo A. The Color Burst Ether Duster.

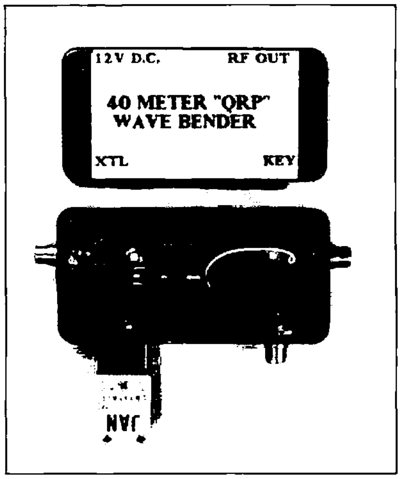

Photo B. The 40m Wave Bender.

Building the Ether Duster

Before starting construction, take a gander at the schematic diagram in Figure 1. Become acquainted with the circuit while your iron is heating up.

Short leads and neat wiring is a must if you choose to build your transmitter breadboard style. But if you take the easy path and use a PC board, construction will be a breeze. Just follow the component placement layout shown in the PC foil pattern drawing in figure 2 and stuff the parts in place. Take extra care in soldering in the two ICs so you don't end up building an unwanted solder bridge between pins.

The output filter coil, L1, is made by winding 24 turns of #26 copper enamel wire, evenly spaced on a T50-2 toroid core.

A Radio Shack deluxe plastic project case (RS 270-221) houses the transmitter in fine style. To duplicate this unit, just follow the general layout in the figure. RCA phono jacks are used for the key, antenna, and receiver connections. A mini-DPDT toggle switch turns the transmitter on, and a three-wire cable with mini-gator clips makes a handy battery connector.

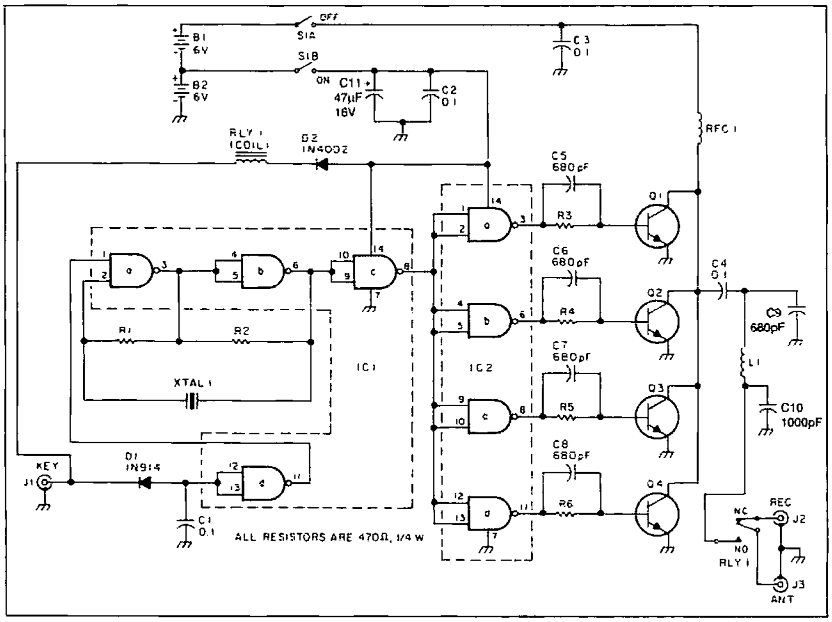

Figure 1. Schematic for the Color Burst Ether Duster.

Firing up the Ether Duster

Two 6-volt lantern batteries connected in series supply power to the circuit. The 6-volt junction between B1 and B2 supplies power to the two ICs. The full 12-volts power the four output transistors.

Connect a 50 ohm, 2 watt (two 100 ohm, 1 watt carbon resistors in parallel) load to the antenna jack and a current meter (500 mA range) in series with the +12 volt battery lead.

If you have an oscilloscope, monitor the RF output. Key the transmitter, and the current meter should read between 150 and 225 mA. A 20 to 30 volt peak-to-peak 3.579 MHz sine wave should then appear on the scope. A 20 volt peak-to-peak output translates into about 1 watt; a 25 volt signal is close to 1.5 watts; and a 30 volt output is about 2¼ watts.

Should you luck out and end up with a stubborn crystal that doesn't start each time the key is closed, just add a 15 to 25 pF capacitor between pin #6 of IC-1 and ground.

Full break-in operation occurs each time the key is closed, with the mini-relay operating in step with each dit and dah. The antenna is transferred from the receiver to the trans-

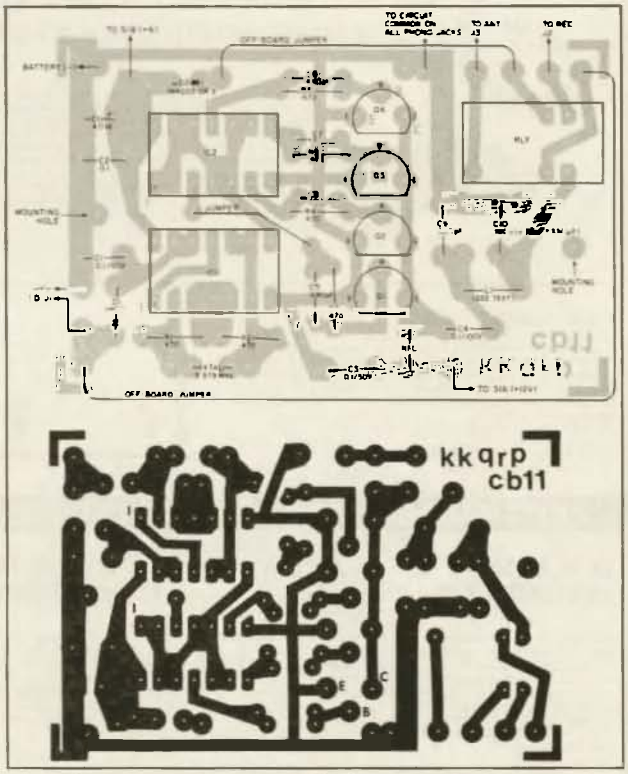

Figure 2. Parts layout and foil diagram for the "CBED."

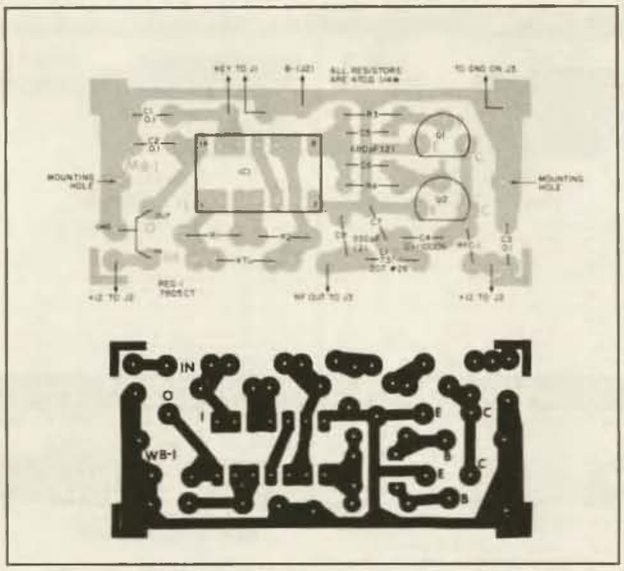

Figure 4. Parts layout and foil diagram for the "WB."

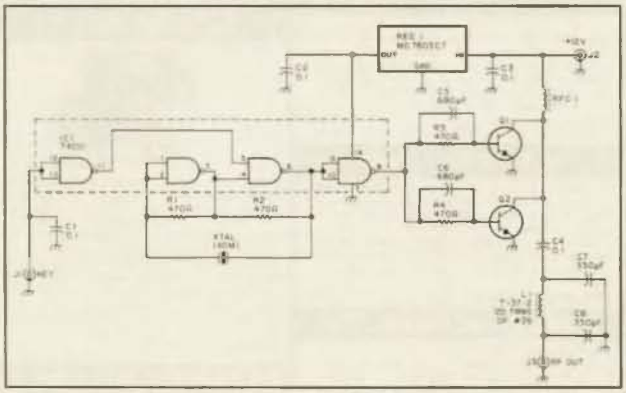

Figure 3. Schematic for the Wave Bender.

Table 1. The Color Burst Ether Duster

B1,B2	6-volt lantern battery	
C1-C3	0.1 µF/50-volt	disc ceramic cap
C4	0.1 µF/100 volt	disc ceramic cap
C5-C9	680 pF/100-volt	disc ceramic cap
C10	1000 pF/100-volt	(680 pF + 330 pF)
C11	47 µF/16-volt	electrolytic cap
D1	1N914	silicon diode
D2	1N4002 or 1N4003	silicon diode
IC-1,IC-2	7400 TTL	
Q1-Q4	2N3904	NPN transistor
R1-R6	470 ohm	¼ watt resistor
RFC	22 µH	choke
L1	24 turns #26 wire	T50-2 core, see test
Relay-1	5 volt relay	RS 275-243 or Mouser #ME431-1205
S1	mini-DPDT	toggle switch
XTAL	3.579 MHz	color burst crystal

Misc.: Cabinet Radio Shack #270-221, phono jacks and plugs, wire solder, circuit board, etc.

You can get a kit of parts for the Color Burst Ether Duster, including the circuit board, for $19.95 postpaid, from Krystal Kits, PO BOX 445, Bentonville AR 72712, or call (501) 273-5340 and ask for KI5AZ. You will have to furnish the enclosure, S1, J1-J3, to complete your TX. A PC board only is also available for $6.25.

Table 2. The Wave Bender

C1-C3	0.1 µF/50-volt	disc ceramic cap
C4	0.1 µF/100-volt	disc ceramic cap
C5,C6	680 pF/100-volt	disc ceramic cap
C7,C8	330 pF/50-volt	disc ceramic cap
IC-1	7400 TTL	disc ceramic cap
Q1,Q2	2N3904	NPN transistor
Reg.-1	7805CT	5-volt regulator IC
J1-J3	RCA	phono jacks
R1-R4	470 ohm	¼-watt resistor
RFC-1	10 µH	choke
L1	20 turns of #26 wire	on T37-2 core
XTAL	Any 40M crystal	

Misc. Radio Shack plastic cabinet, RS 270-220; wire, solder, circuit board, batteries, etc.

You can get the 40 meter Wave Bender, including the circuit board, in kit form from the author at Krystal Kits for $14.95 postpaid. You will have to furnish the enclosure, jacks, crystal, and socket to complete your transmitter. A PC board only is $5.25. See Table 1 for the address.

mitter's output with each key closure and back, to receive in the key-up position.

The Color Burst Frequency

You might wonder why anyone would want to operate a QRP transmitter on a frequency that every color TV set in the country generates. Good question. Well, first, it's a legal 80 meter frequency, and second, there is an unlimited supply of cheap-to-free 3.579 MHz crystals from secondhand and junk color TVs. And if you monitor the frequency for a while, you'll hear a lot of CW activity, including a couple of nets. It's another challenge for the QRPer! I'll be looking for you on the Color Burst frequency.

The 40m Wave Bender

The Wave Bender transmitter is about twice as easy to build, especially if you use a PC board. Just follow the layout in the figure and solder each component in place.

The output filter coil, L1, is made by winding 20 turns of #26 copper enamel wire evenly spaced on a T37-2 toroid core.

The completed circuit board fits snugly inside Radio Shack's deluxe plastic project case (RS 270-220). The battery input, the key, and the RF output connections are all made through RCA phono jacks mounted to the enclosure.

The XTAL socket is also mounted in a similar fashion.

Plug in a good 40 meter crystal, and connect a 50 ohm, 2-watt load to the RF output. Connect a milliampere meter (0 to 500 mA) in series with battery positive, and close the key. If you're not in cahoots with Murphy, the current meter should read between 125 and 160 mA on key-down, and about 25 mA on idle. The RF across the 50 ohm load should be between 15 and 20 volts peak-to-peak, for an output of 500 milliwatts to slightly less than 1 watt.

The 40 meter Wave Bender is basically the Color Burst circuit cut in half. See Figure 3, the circuit diagram. All you need are two transistors and one IC. There's no provision for break-in operation. Just about any fundamental-cut crystal will oscillate in the circuit; the readily available and inexpensive FT-243 type of crystal was my choice.

A 7805CT 5 volt regulator simplifies the battery hook-up, which also allows the circuit to operate with an input of 8 to 12 volts. By changing the supply voltage, the RF output can be set for a special QRP power output level.

Now for the real fun—making that very first contact with your very own home-built QRP transmitter. Good luck, and 73s from KI5AZ down in the Ozarks and back in the hills.

Charles D. Rakes KI5AZ, PO Box 445, Bentonville AR 72712.

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A Better Tube Tester

Check more than just DC amplification.

by John Shelley WA1IAO

Even in these days of increasingly sophisticated solid state equipment, many hams still buy and use tube-type equipment. There's a lot of perfectly usable old gear at hamfests you can pick up. Still, you need to be able to check it.

Most hams use GM (transconductance) tube checkers in their shacks. I cringe when I see someone buying a military or commercial checker at a flea market, because I have gotten very few accurate readings from them in my thirty-odd years of using them.

How could these boxes with all their switches, knobs, and meters not solve the mysteries of the glowing bottles? Simply put, most checkers were designed to test the tubes as if the tubes were DC amplifiers, and there is too much cumulative error built into them. The worst part is that they lack a sensitive leakage test.

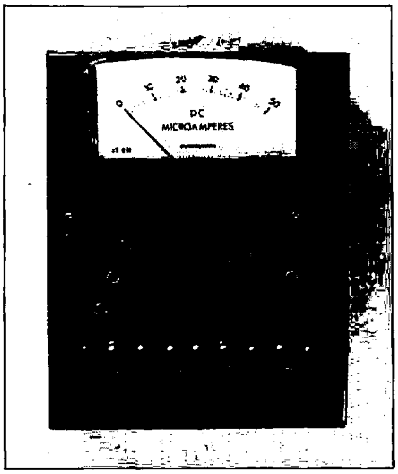


Photo A. The completed tube tester.

Checking Tubes

I watched military tubes deteriorate. Commercial tubes soon followed. For instance, Western Electric made quality tubes for their Nike missile system, but other manufacturers soon outbid them, with disastrous results. At one time in the sixties, Congress tried to withhold funding for military systems because their inspections had shown that the average time between failures was six hours. The resulting hue and cry, along with promises of great breakthroughs, was sufficient to push the budget through, however. The problem lay in there not being a valid test for tubes.

A Tektronix field engineer once held a seminar at our shop to help us learn how to fully use their instruments. Ours was the first facility at which he found all circuits properly calibrated and operating. The calibration of a 545 scope, for instance, is a cumulative process. Every step depends on obtaining the proper adjustment and using quality parts in its construction. The probability of their changing value or tuning by themselves is practically nil. The many tubes involved, however, can cause profound changes due to contaminants.

It was awful seeing technicians chasing contaminants and repeatedly adjusting pots, hoping that the reading would suddenly pop into specs. It drove some to despair: A Hawaiian National Guard Technician reportedly tried to charm a defective radar scope into operation by chanting and shaking a tea leaf at it!

To many, the 10-channel AN/GRC-27 was a monster. But once tuned with clean tubes, they were easily managed by periodically purging them of leaks—little or no retuning required!

The worst example of equipment failure I ever found was in the ACV/TVM model ME-6c/U. Its amplifier tubes were 6BH6s, and I never found a good one in JAN (military) stock. The meters were totally useless because, with those tubes, they would do nothing but oscillate or freeze against the pins.

Finding Leaks

My tube checker uses high sensitivity to look for leakage. It is small, easy to build, and it finds bad tubes ranging from audio amplifiers to UHF oscillators. Using a voltage near B+ potential, the tester tries to read it through the (presumably) empty spaces between elements. (Note: The large, octal, transmitting-type tubes are not included in this discussion; they are better tested in-service.)

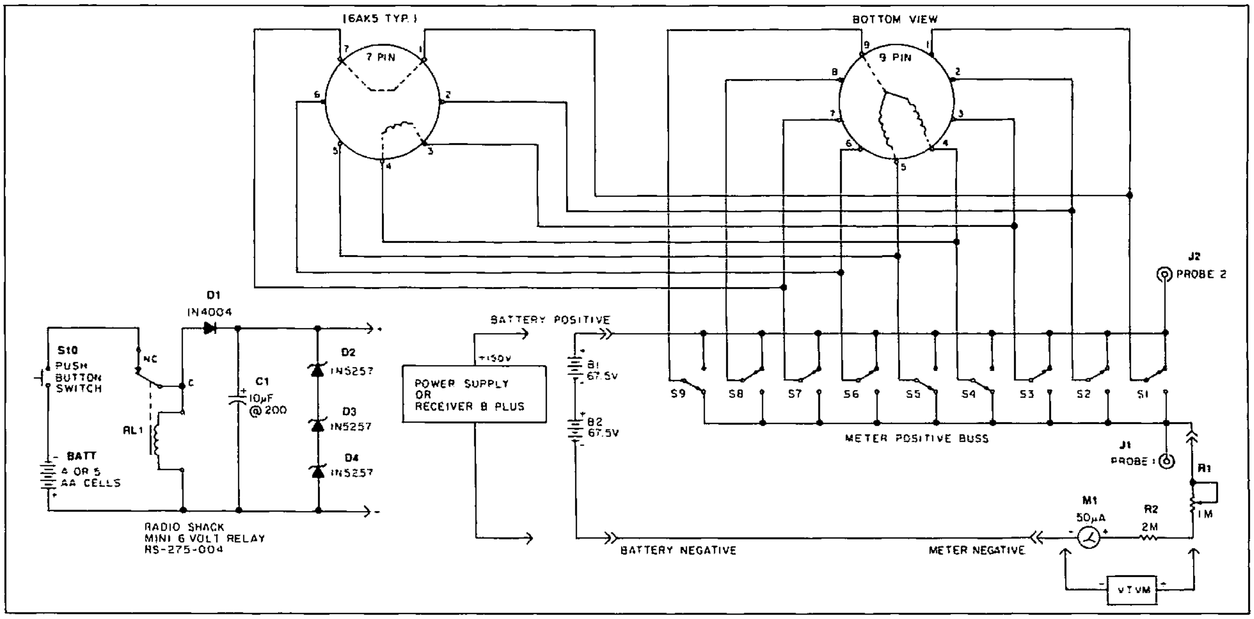


Figure 1. Schematic diagram of the tester.

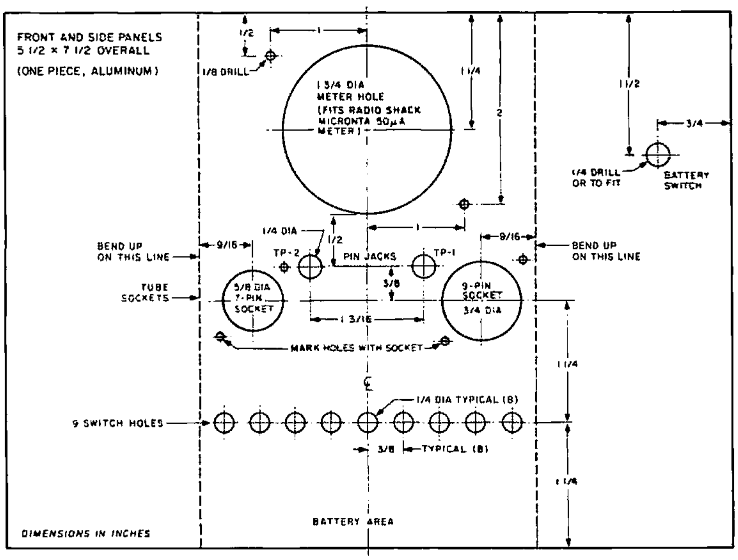


Figure 2. Front panel drilling template. Note that the Radio Shack meter has been discontinued. Use dimensions to fit your particular meter.

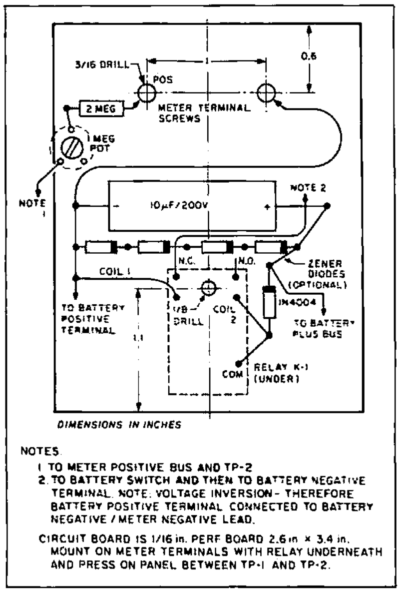


Figure 3. Internal circuit board parts placement. All parts mounted on perfboard. (Note the optional parts if using Option A on Figure 1).

By accident, I discovered how leaks cause malfunctions. There was a walkie-talkie battery on my workbench, with a set of test leads attached to the 135 volt terminals. We used it to test electrolytic capacitors at near-working voltages. At one time, it detected a group of leaky, screen-bypass capacitors which had prevented us from obtaining proper sensitivity figures in a series of receivers we had to maintain.

One day I was checking out a receiver someone had brought in after unsuccessful attempts to stop it from buzzing. He checked the filters and tubes, to no avail. With the small amount of knowledge I had then, I attacked the problem. Hoping to find a motorboating capacitor, I isolated the B+ lead from the power supply and attached a VTVM in series with the battery, and the B+ path to ground. There was a leak! Why, though, was it not oscillating?

Next, I removed the tubes to prevent breakage while I unsoldered the capacitors. Lo and behold, the leak disappeared when I removed the first tube. Sure enough, there was a leak between the filament pins and one of the grids of the mixer tube. Apparently the 60 Hz from the filament was modulating the local oscillator, and sending the products down through the IF and audio circuits.

As time went on, I found leaks in many tubes, bridging all possible combinations of elements. I soon found it necessary to build a switch box containing a battery and sockets, to eliminate the hassle of manipulating the tubes and test leads in my hands. This became the mainstay of our Signal Corps repair shop, and later, the Ordnance missile radar shop. We practically eliminated troubleshooting, except for shorted electrolytics and obviously broken or burned parts.

Construction

If you own some pieces of tube equipment, you should at least build a portable checker. In its simplest form, it uses a 50 μA meter movement instead of a VTVM. This provides reasonable sensitivity, and will fit into a hand-held box. You can take it to flea markets and save yourself from disappointment by testing tubes before you buy them.

See Figure 1. The dotted filament on the 9-pin diagram shows the most common arrangement of a 9-pin tube. S-4, S-5, and S-9 are shown down, to allow you to check leaks from the filament to all other pins. Similarly treat the most common 7-pin tubes by pushing down S-3 and S-4 simultaneously. Multiple pins for any element should be switched together. Otherwise, the common connections will short. The control grid of a 6AK5, for instance, has connections to both pins 1 and 7. Actuate all other switches singularly to look for leakage paths. When a switch is down, lightly tap the tubes to bring out indications that may may be temporarily hidden. Then, return the pin to the up position before going on to the next one. Pin jacks TP-1 and TP-2 are used to check tubes that have non-standard bases, using test leads.

I suggest that the panel, at least, of the box be made of metal and connected to the battery's negative terminal.

A tester can also use the leads to find leaks in capacitors and even in wiring. Once I found a leak that had confounded technicians. They were searching for whatever had caused a circuit to overload a power supply, and they had found nothing with an ohmmeter except the 135 volt feed wire to the circuit. Probing the wiring, however, caused variations in the meter reading. I found a charred area hidden where the insulation of a wire came in contact with a metal part. It seems that a nearby lightning strike had arced through and disabled an entire radar system. It is unfortunate that we cannot use a high potential on modern, low-voltage circuitry, to find breakdowns such as these.

Parts List

S1-S9	SPDT toggle switches
J1,J2	Test jacks
R1	1MEG potentiometer
R2	2MEG resistor
M1	50 μA panel meter
Power supply	
—Option A:	
S10	Momentary contact switch
RL1	6 volt relay (RS# 275-004)
D1	1N4004 diode
D2,D3,D4	1N5257 zener diode, 33 volts at ½W
C1	10 μF/200 volt electrolytic capacitor
—Option B:	
Any 90 to 150 volt DC supply	
—Option C:	
B1,B2	67.5 volt batteries in series (Eveready #416, Newark Electronics #49F1009)

Points To Remember

Some important points are in order. One is that sunlight causes conduction in some tubes, and they should be shaded during testing. Another is that they should be clean, especially between the pins. Holding them in perspiring hands just before testing them will show leaks, as will not letting them cool off for at least two minutes after operation. Each switching operation causes a capacitive kick on the meter, and each user will have to decide on a tolerable residual reading for his particular setup.

Also, if solder flux other than rosin is used to build the tester, all socket pins will show leakage—permanently. Surprisingly, some leakage paths show diode characteristics, so a thorough test would require starting with all switches down and sequencing them upward in addition to the initial test.

In spite of their high-power consumption, tubes are one of the greatest inventions in history. When not contaminated, they give many years of reliable service. ■

73 Review *by Peter Ferrand WB2QLL*

The JPS NIR-10

Separate the words from the noise.

JPS Communications, Inc.
P.O. Box 97757
5516 Old Wake Forest Road
Raleigh NC 27609
Tech Info: (919) 790–1048
Orders: (800) 533–3819
Price Class: NIR-10, $395;
AC Adapter, $12, including shipping.

"All you ever do is listen to noise!" Is that how people have described your hobby? Now, thanks to state-of-the-art digital signal processing, you don't have to listen to that complaint—or to most of the noise—anymore.

The JPS NIR-10 Noise/Interference Reduction Unit is the first unit on the ham market to identify what human speech sounds like, then separate it from most of the other stuff on the band: ignition and power line noise, computer noise, heterodynes, and even the white noise generated by atmospheric conditions and within the receiver. It won't make listening to 75 meter sideband sound like your local FM broadcast station, but under reasonable conditions the constant racket under single sideband voice signals will hardly be noticeable anymore. If you've been hearing that same noise for more than 30 years, as I have, you may not even think about it, but noise is fatiguing. It has left me with a ringing in the ears—even after an interesting QSO.

The NIR-10 won't take a signal that's down in the noise and magically bring it out into the clear (one of my fondest dreams). Its biggest improvement is on signals at least one-half to one S-unit above the noise, where there's enough speech information to extract. Take a quick look at the before and after oscilloscope plots in Figures 1 and 2. In each, the top trace is the noisy HF sideband signal from the receiver; the bottom trace shows the audio output of the NIR-10, cleaned up and slightly delayed.

The NIR-10 is wired up between your receiver's speaker output and its speaker, just like a standard audio filter, although JPS doesn't want you to think of the unit as a filter in the normal sense of the word. Actually, the NIR-10 has two modes: the NIR mode which separates the speech sounds from the noise, and a bandpass mode which acts as a very selective filter.

The bandpass mode is intended primarily for nonvoice modes, and provides a choice of three bandwidths and a variable center frequency. Since digital signal processing (DSP) is used for the bandpass filter, the sides of the filter's slope are very nearly straight when plotted on a graph showing bandwidth versus amplitude. Ultimate selectivity is achieved at just slightly beyond the three bandwidths of 200, 600, and 1,500 Hz.

The bandpass mode performs well and is sharper than the analog or switched-capacitor designs I've used, but most of this review concerns the NIR mode, since that's what really makes the product unique.

Getting Started

The NIR-10 is a small black box, 2" x 7" x 6" (HWD) that will sit discretely atop your rig. This is probably the best spot for it, since you will be frequently manipulating the controls.

Hookup couldn't be easier: Audio from the receiver goes into the input jack, and your station speaker goes to the NIR-10 output jack. All that remains is to feed in power from the optional wall transformer or your regular station supply, 11 to 15 volts DC at 1 amp peak. Then you turn the receiver volume control up to the point where the NIR-10 "peak" indicator begins to flash on voice peaks, and from then on use the NIR-10's volume control to adjust the speaker level.

A toggle switch moves the NIR-10 between bypass, bandpass, and NIR modes. When in NIR mode, a rotary control also adjusts the level of interference reduction; the same control adjusts the device's center frequency when in bandpass mode. The rest of the front panel includes a three-position bandwidth switch for the bandpass mode, a headphone jack, and the on/off switch.

The World of Noise

The big problem with noise reduction is that there's an infinite variety of different types of noise. Any noise reduction scheme must represent the designer's best guess on what the difference is between the noise and the desired signal. You've probably noticed how the noise blanker on one rig works better on particular types of noise, and a different rig can best eliminate a different sort of noise.

As the NIR-10 tries to separate noise from speech sounds, it runs into the basic limitation that speech corrupted by noise doesn't sound much like speech anymore. So if there's not much difference between the noise and the signal, there's not much it can do, and removing the noise leaves you without an intelligible signal. Depending upon the specific noise, the NIR-10 will produce its most impressive noise reduction when the desired signal is about one S-unit stronger than the average noise level. JPS specifies that the NIR-10 is capable of up to 20 dB of white noise reduction, and 40 dB of tone elimination. Keep in mind, though, that the inherent limitation of the NIR-10 is that the stronger the signal, the more noise it will eliminate.

The NIR-10 does a superb job on ignition interference, where cutting down the typically high noise level makes for far easier listening. While the NIR-10 will reduce tones and heterodynes, it won't get them all the way down, as a notch filter will. Keep in mind, however, that a notch filter will only handle one tone, while the NIR-10 will reduce all the tones it finds.

On the other hand, since adjacent channel splatter from other stations is a form of speech, the NIR-10 won't reduce them at all; its NIR mode does not reduce bandwidth beyond the 3.2 kHz it normally passes. So, a notch filter and a conventional bandpass filter are still useful. I find they work better if they act on the signal before it gets to the NIR-10. A noise limiter is still useful, since some types of static crashes are too fast for the device to respond to.

The NIR-10 works on speech, so it will work fine with AM, FM, and SSB, but music is pretty badly chopped up. You can still generally hear the speech component of music, and that's useful if you're trying to ID a broadcaster.

Note that the action of the digital processing produces a delay between the input and the output signals of about 130 milliseconds. This isn't normally a major problem, and you'll quickly get used to a backlash-type effect as you tune around. It does, however, make the unit unsuitable for fast turnaround modes, such as two-way AMTOR.

Seeing the Effect

To illustrate the effect and create Figures 1 and 2, I used a LeCroy 9410 digital oscilloscope. I tuned the receiver to a sideband station, and displayed amplitude in the vertical axis and time in the horizontal, using a plotter to create a printout. The top trace shows the

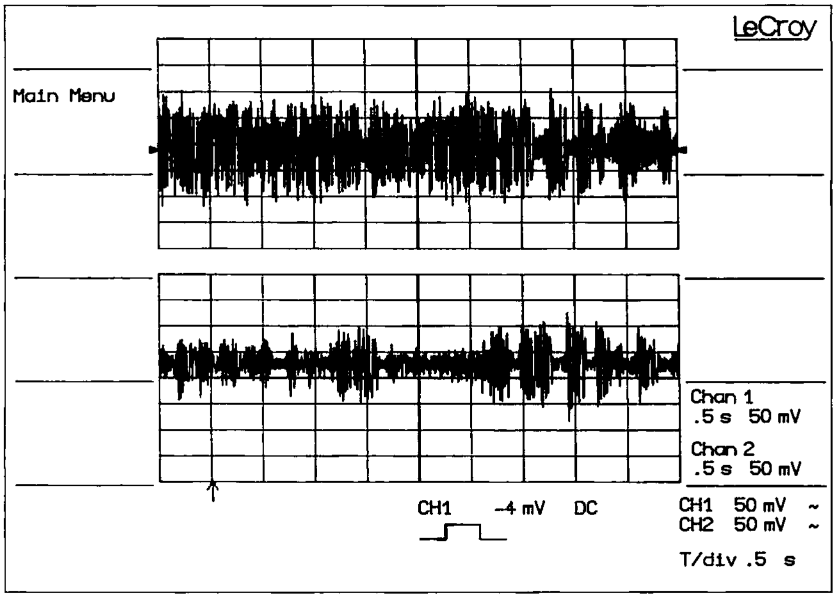


Figure 1. A 20 meter sideband signal partially covered with power line noise. Note the difference between the top trace, the input to the NIR-10, and the bottom trace, showing the cleaned-up output.

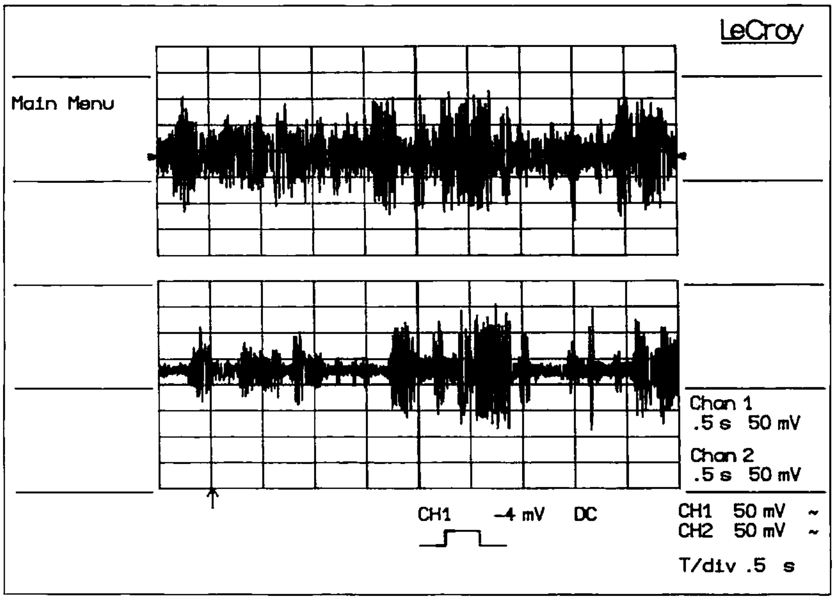


Figure 2. A 40 meter sideband signal during the midday (top trace). The bottom trace shows the results after processing by the NIR-10. The increased dynamic range between the signal and noise is quite obvious.

All scope traces taken with a LeCroy 9410 digital oscilloscope contributed by John Seney WD1V.

audio input to the NIR-10; the bottom the output.

Figure 1 shows a 20 meter signal with a severe local power line noise, mostly in the first half of the trace. The NIR-10 had no trouble eliminating it, leaving something close to a normal speech pattern.

Figure 2 shows a 40 meter midday QSO with more random atmospherics. You can easily see the speech waveforms and their amplitudes preserved, while the noise between the speech bursts is greatly reduced. You can also clearly see the offset between the input and output traces, showing the unit's internal delay.

What the plots don't show is the effect of adjusting the NIR level control. A signal close to the noise level would allow only a small amount of noise reduction, perhaps in the 9 o'clock position of the control, before it becomes too choppy to be intelligible. As the signal becomes stronger, you can turn up the control for more noise reduction, with most signals optimized with the NIR control at about 12 o'clock.

As the noise reduction takes place, you'll notice that the remaining noise sounds a lot different than you're used to, primarily because it has been "de-randomized" into low-level, very short-duration tones described as "beedely-beeps." It's not annoying, just different.

CW operation is improved in the NIR mode, too, except for slow CW, which the device will try to attenuate. By greatly reducing the noise, copy via a computer system such as a multimode TNC produces a lot fewer errors.

Operating Notes

JPS has cleverly provided the capability to switch the NIR-10 into bypass mode electronically, in addition to using the front panel switch. Thus, you can connect the "remote bypass" to the push-to-talk line of your rig and monitor your transmissions without the delay.

The NIR-10 can also be used for transmitting, providing a more effective method of communicating in a high-noise environment than a noise-canceling microphone. You'll have to work up your own switching scheme if you want to use the same unit for both transmitting and receiving.

JPS provides a concise but complete manual, describing both the hookups and the philosophy of the NIR-10's design and operation. This approach is especially valuable because the NIR-10 represents a new category of equipment on the market. A partial schematic is included for troubleshooting the simpler parts of the set; a block diagram illustrates the actual DSP logic.

Even in bypass mode, the NIR-10 still works as an amplifier and the volume control is in the circuit, meaning it has to be powered up in order to hear anything fed to it. It's a minor quibble, but I find setup and troubleshooting simpler when things are completely out of the circuit when bypassed.

All digital devices tend to create noise of their own, and the NIR-10 under test did produce some digital noise on a nearby broadcast radio, although there was no noise detectable on my ham equipment when attached to an external antenna. JPS says improvements in shielding and filtering have greatly reduced this effect in current production units.

Physically, the NIR-10's workmanship is excellent and shows evidence of the JPS commercial equipment line, from which it's been adapted.

It's Worth Having

We're going to be seeing a lot more of digital signal processing in our communications equipment, and it's fun to think about a future where we can sit at a keyboard and optimize all possible signal conditioning parameters to combat any interference. On the other hand, I have a half dozen audio filters and sometimes I think all they do is provide knobs to turn when there's no signal to hear.

At no time was there ever a signal I could copy with the NIR-10 that was unintelligible without it. Yet the NIR-10 requires minimum tinkering and does exactly what it is supposed to do: make ham radio contacts easier to listen to. If you are tired of all the noise in your ears, and especially if you spend a lot of time listening, then the JPS NIR-10 is worth having. 73

Contact Peter Ferrand WB2QLL at 65 Atherton Avenue, Nashua NH 03060-1904.

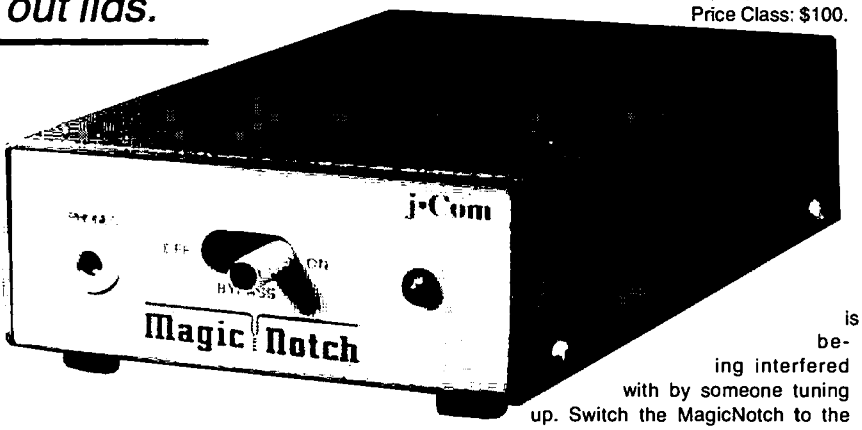
73 Review

by David Cassidy N1GPH

The J•Com MagicNotch Audio Filter

A little box that locks out lids.

J•Com
P.O. Box 194T
Ben Lomond CA 95005
Tel. (408) 336-3503.
Price Class: $100.



Amateur radio is full of gadgets. We have gadgets to measure things, gadgets to amplify things, gadgets to attenuate things, as well as gadgets to help us make other gadgets work better.

Some gadgets end up at the bottom of the closet or drawer. They may operate as advertised, but once you get them installed, you realize that what they do is something that doesn't really need doing. Other gadgets become a permanent part of your setup, because the manufacturer has solved a particular problem. J•Com's MagicNotch audio filter lands firmly in the second category. It's a simple solution to a very irritating problem: interference from a continuous carrier heterodyne signal (like when someone tunes up on top of your QSO).

The MagicNotch is an automatic notch audio filter. It requires no tuning, calibration or attention of any kind. You simply place it in between your rig and an external speaker, supply 12 volts, and turn it on. When the MagicNotch detects the presence of a continuous carrier, it filters it out with a very sharp notch filter. Audio of other frequencies, such as speech, are unaffected and pass through the filter without attenuation.

How It Works

According to the folks at J•Com, the MagicNotch uses a switched capacitor active filter (SCAF), which is scanned through your rig's audio output. A control circuit monitors the filter's output and stops scanning when it detects a continuous carrier. The filter then locks onto the precise frequency of that carrier and notches it out, tracking the interfering signal for any variations in tone until the interference disappears. Then the filter resumes scanning, searching out the next offensive carrier.

On-the-Air Testing

Setting up the MagicNotch is easy, and J•Com includes power and audio cables. The back of the MagicNotch has "audio in," "audio out," and 12V DC in jacks. Connect your rig's external speaker output to the "audio in" jack, connect your speaker to the "audio out" jack, connect 12V DC to the power jack, and you're in business. You can use any filtered power supply for the 12 volts (maximum current at full output is only 200 mA). Many HF rigs operate from 12 volts, and you may have an accessory power jack on your rig. Check your rig's owner's manual. I used a small 3 amp supply that I had sitting around.

The front of the MagicNotch has a 3-position slide switch, an LED, and a mini headphone jack. When you slide the switch to the center position, the MagicNotch is in standby mode (labeled "Bypass" on the panel). The LED will light green (if you've got it wired correctly). As you tune through the band, the LED will flicker to red and back to green. When a continuous carrier is detected, the LED will change to a steady red, indicating that the notch filter has locked onto the carrier. In the "Bypass" position, you will still hear the interference in your speaker. Sliding the switch to the "On" position will place the filter in the audio line, and the interfering signal will be filtered out.

To really get a taste of the effectiveness of the MagicNotch, leave it in the "Bypass" position and tune around for an SSB QSO that is being interfered with by someone tuning up. Switch the MagicNotch to the "On" position and the tuner-upper is gone, leaving only the SSB signal. No matter how weak the SSB signal is, or how strong the CW carrier is, the MagicNotch will eliminate the interference and leave the SSB signal intact.

Now, when a lid tries to tune up on top of your QSO, a simple flick of the switch and the lid is gone. If you leave the MagicNotch in the "On" position, you'll never even know the lid was there.

Be sure to switch the MagicNotch to "Bypass" or "Off" when you want to monitor CW. The filter may notch out what you're trying to copy!

MagicNotch Specifications

Notch depth	40 dB
Gain	0 dB
Active range	200–4000 Hz
Filter Q	10
Power output	2 watts (8Ω load)
Power required	10–14 VDC
standby	40 mA
full output	200 mA
Minimum signal for lock	20 mV P-P
Maximum signal	4 V P-P
Audio connectors	0.125" mono phone
Power connector	0.220" coaxial
Size	5.5" x 3" x 1.25"

Nice Touches

The MagicNotch is an example of a product that is designed to do a specific task, and it does that very well.

The short instruction manual is well written and informative. The inclusion of the power and audio cables in the purchase price is a courteous and convenient gesture that other companies would do well to imitate.

The front panel headphone jack is a mini-stereo jack that allows you to use the headphones from your portable stereo/tape player. If you've ever spent all day with a large set of headphones clamped to your head, you'll appreciate being able to use lightweight headphones for a change. Some might question the frequency response of headphones intended for music listening used for communications, but I like the more balanced tone of a stereo headphone.

In a hobby full of gadgets, it's nice to find one that is a useful addition to your shack. The MagicNotch is just such a gadget. I call it my "lid filter." 73

Apartment Antennas: A Challenge

How to cope with a less-than-ideal QTH.

by Stan Gibilisco W1GV

I recently moved into an apartment complex where outdoor antennas are not allowed. This predicament is not unfamiliar to radio hams and shortwave listeners. It does not have to mean a low-performance station, but it inevitably means that there must be some compromises. A full-size, 4-element, 40 meter yagi, and other such antennas, are out of the question.

Here are some of the schemes I have tried so far, and some ideas for future experimentation. I can always go back to my parents' house on the hill to work contests and DX, and this is the attitude I carried into the new apartment.

Survey the Layout

Whatever your particular situation, you will immediately see some obvious possibilities for antennas if you take the time to look things over.

My apartment is on the third floor of a three-story complex. My main motivation for choosing this location was noise: No one will be clomping around above me all day and all night. It turned out to be good from a ham radio standpoint, too. The ceiling is 30 feet above the ground. The building is old, and is therefore probably not of the solid concrete-and-steel Faraday-shield construction typical of newer high-rise complexes. There is a fire escape right outside the living room window, a formidable mass of metal that ought to make an excellent ground for a high-impedance antenna system.

The point is that any apartment will have some redeeming properties for radio communications. Well, almost any. Perhaps my friend who used to live in Arlington, Virginia, had just about the worst deal I have ever seen, a low floor in a jungle of tall buildings. Evidently hamming was not high on his list of priorities.

Any apartment living arrangement presents the danger of RFI and it is far better to put extra effort into the antenna system than to attempt to overcome a deficiency by running high power. I prefer not to get into wars with my neighbors. I'd just as soon have them never suspect I am a radio ham and never have any interference from me. With this in mind, I kept in mind the corollary to the antenna restriction: If you never get caught with an outdoor antenna, then, in effect, you don't have one as far as the management is concerned.

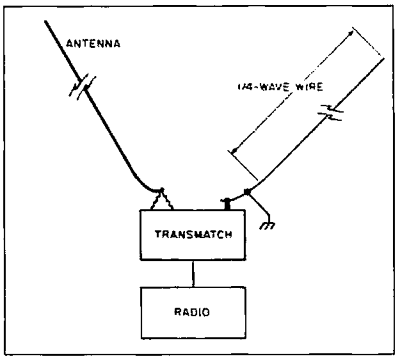


Figure 1. Installation of a ¼ wavelength "radial" wire as an RF ground. The wire should be as straight as possible, and the far end left free.

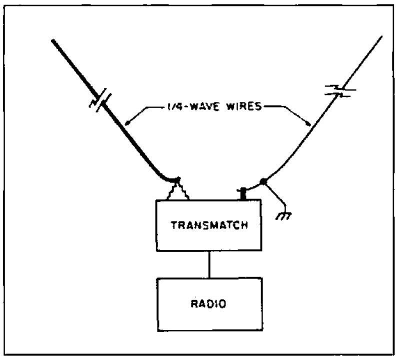


Figure 2. When a ¼-wave, end-fed wire antenna is used with a ¼-wave ground lead, the result is a center-fed dipole antenna. In this case the "radial" contributes to the radiation of the antenna system.

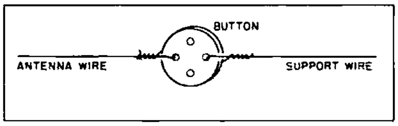


Figure 3. A button may be used as an insulator for "invisible," low-power antennas.

This last statement is not intended as an encouragement to break the rules of your lease. You do that at your own risk. If you try it and get into trouble, I shun all responsibility.

Establishing Ground

I cannot overemphasize the importance of obtaining a good ground for radio-frequency communication. A good direct-current (DC) ground is not necessarily a good radio-frequency (RF) ground.

The term "RF ground" is somewhat nebulous. A good ground at one frequency may be terrible at another frequency. The type of antenna being used makes a great difference.

If the ground loss resistance is given by R_L and the antenna input radiation resistance is given by R_R, then the efficiency of the ground system is given by:

$$Eff(\%) = 100 \bullet R_R/(R_R + R_L)$$

The higher R_R is, compared to R_L, the higher the efficiency of the ground system. End-fed antennas measuring an integral multiple of 1:2 wavelength tend to have very high values of R_R and are therefore best for use when the RF ground is marginal—and in an apartment situation, it almost always is marginal, at best.

You can get a good RF ground by installing a quarter-wavelength wire at the station transmatch or transmitter chassis, as shown in Figure 1. This will produce high current, and therefore low resistance, at the operating frequency, and also at odd integral multiples of this frequency. Such a "radial" ground wire will radiate to some extent, but this is minimal when the antenna feedpoint resistance is very high. If the antenna is a quarter-wave wire with a rather low feedpoint resistance, the arrangement will combine with the antenna to form a dipole having a feeder length of zero (Figure 2). This arrangement will still function quite well. For multiband operation, multiple "radials" can be installed, each cut to ¼ wavelength at the center of the desired band according to the equation:

$$L(feet) = 240/f(MHz)$$

where L is the length of the ground lead and f is the frequency. The far ends of these "radials" are left free, not connected to any object.

MFJ Enterprises, Inc., makes a tuner designed especially for resonating an RF ground. According to a *QST* review, this device works quite well.

The Transmatch

I have mentioned the use of a transmatch almost as if it were given that you have one. It ought to be; transmatches are indispensable

for apartment dwellers and any radio ham who operates portable very often. The added versatility is well worth the cost of the device.

The best transmatches allow for tuning random wires and balanced feeders. Most modern transmatches employ ferrite balun transformers to obtain tuning for balanced antenna systems. This is fine as long as the core does not saturate during transmission. Depending on the impedance at the feedpoint, the core may saturate at power levels much lower than that specified by the manufacturer for operation of the transmatch. I have actually cracked a ferrite balun core using 500 watts output when the transmatch specifications stated that it was usable up to 3 kW. This same transmatch became quite hot during operation using 500 watts output and an unbalanced ⅝-wave wire at 1.8 MHz. The choice of a transmatch is obviously important. In general, those with very large components will be better suited for high power (more than 200 watts output) than those with smaller components, even if the latter carry impressive specifications. Certain laws of nature will not yield to miniaturization technology—not until we have superconductor coils and cryogenic vacuum-variable capacitors!

The main advantage of a transmatch is that it allows practically any antenna to be resonated. You should choose the antenna with efficiency in mind, regardless of the availability of a tuner, but high-impedance antennas, the kind that work best with marginal grounds, generally require a tuner to produce an acceptable standing-wave ratio (SWR).

A Simple End-Fed Wire

Perhaps the simplest antenna is an end-fed wire, running directly to the output of the transmatch and cut so that it is an integral multiple of ½ wavelength on all of the desired transmitting bands. In amateur radio at high frequencies the bands are harmonically related, so if an antenna is cut to be ½ wavelength at 80 meters it will be close to an integral multiple thereof at 40, 30, 20, 15 and 10 meters.

Outdoor antennas are often not allowed, but a thin wire, three stories above the ground, is difficult to see. I recommend enameled copper wire of American wire gauge (AWG) No. 24 or smaller, down to AWG No. 30. The larger wires are physically stronger but more likely to be seen; the finer wires are more likely to break. Don't string such an antenna where it might cause problems for people if it breaks. Keep in mind, also, that if there is a frost, an "invisible" antenna may greet you some morning with an announcement to the world almost comparable to reveille.

The far end of a thin wire antenna may be tied to a button as an insulator, as shown in Figure 3. Allow plenty of slack for the wire to swing with the wind. A strong tree branch is all right for the far end of the antenna, but a solid, stable object is superior since it will not move in a wind. Avoid stringing the wire over or under utility wires. Table 1 gives good lengths for wires for various lowest amateur bands.

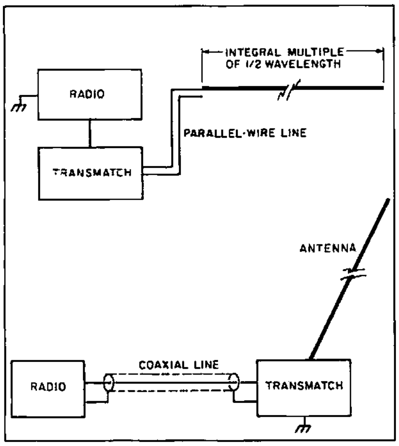


Figure 4. In drawing "a," a parallel-wire feedline is used with an end-fed wire that is very close to an integral multiple of ½ wavelength. In "b," the transmatch is located some distance from the transmitter, and the antenna is end-fed through the transmatch.

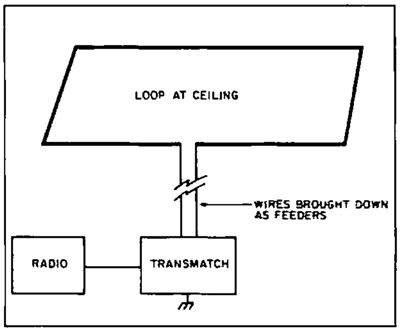


Figure 5. An indoor loop may be fed by bringing the wires down from the ceiling, parallel to each other, to the balanced output of the transmatch.

For shortwave listening the length is less critical, since antenna efficiency is not as important. Generally, a length of at least 50 feet will suffice, although longer wires are recommended for listening below the 160 meter (1.8 MHz) amateur band, and at longwave frequencies, length should be as great as can be managed.

The disadvantage of an end-fed wire is that the radiating portion of the antenna comes right down to the station. However, in an apartment situation where the landlord will not allow rooftop antennas, long feedlines are impractical anyway. If the station must be located away from the window where the antenna comes in, then a parallel-wire line may be used and the antenna connected to one end of this line. However, the antenna must be very close to an integral multiple of ½ wavelength to avoid line radiation (Figure 4a). Alternatively, you can run coaxial cable from the transmitter to the feedpoint, then connect the tuner to the antenna and RF ground at this remote point (Figure 4b). This is inconvenient when it comes to changing bands, but it is the best alternative in some cases. The RF ground must be connected and effective at the transmatch when this scheme is used.

An Indoor Loop

Simple end-fed wires may be connected for use indoors, although the lengths may vary somewhat when the wires are not straight. For indoor antennas, a balanced loop is probably better than an end-fed antenna.

Basically, the loop antenna always presents a balanced load at the input. This eliminates the need for a good RF ground and also gets rid of frequency sensitivity. The loop should be at least ½ wavelength, and preferably at least one wavelength, in circumference.

My apartment is quite large, and the ceiling is about 30 feet above ground level. An indoor loop, run around the entire apartment at the ceiling level, was an obvious choice. I installed this antenna almost before I got all the furniture in and the bed made up. I found stranded, insulated AWG No. 20 wire at a surplus shop for a few dollars. Hamfests are great places to get wire like this. I connected the loop to the balanced terminals of the antenna tuner, without regard to the overall length of the loop: I knew only that it was at least 100 feet in circumference, and close to a full wavelength at 7 MHz. I did the tuning on all bands, 80 through 10 meters, and logged the transmatch settings for future reference.

The loop was fed by bringing the end wires down parallel to each other, as shown in Figure 5.

Separate Receiving Antennas

Indoor antennas, and any antenna in a population-dense place like an apartment building, will pick up considerable man-made noise. The noise blanker on my FT-101EE is effective against much of this noise, but some broad-spiked noise is difficult to suppress with any noise blanker. In some cases a special receiving antenna may be needed.

A small loop with a tunable preamplifier is an asset in noisy places. The loop should be rotatable in both the vertical and horizontal planes, allowing you to find the noise null. It can be exasperating when there is more than one noise source and they keep alternating; the loop may need

Table 1. Lengths of wire antennas (end-fed) for half-wave operation at various amateur bands. The bands are indicated in meters, with the lowest frequency band first. Half-wave resonant frequencies are given in MHz, and represent the centers of the lowest bands.

Bands of Operation	Resonant Frequency	Wire Length Feet	Wire Length Meters
160, 80, 40, 30, 20, 15, 10	1.900	246	75.1
80, 40, 30, 20, 15, 10	3.750	125	38.0
40, 20, 15, 10	7.150	65	19.9
30, 15, 10	10.125	46	14.1
20, 10	14.175	33	10.1

frequent adjustment. The subject of receiving loops is complex and is beyond the scope of this article. However, Doug DeMaw W1FB has written numerous articles in *QST* about receiving loops.

Commercially-manufactured receiving loop antennas are available. Palomar Engineers manufactures one that has a preamplifier and a ferrite loopstick that can be rotated in both the vertical and horizontal planes.

A separate receiving antenna is, of course, necessary only for ham stations in which there is also a transmitter. When a separate antenna is used for receiving, precautions must be taken to ensure that the signal from the transmitter does not damage the receiver front end or the preamplifier. Some preamplifiers have protection built in. Some don't. Protection may not be necessary at low levels of transmitter power, but it is always a good idea.

That Gremlin: RFI

Radio-frequency interference (RFI) is so common nowadays that, unless you are running milliwatts or are extremely fortunate, you will encounter it in an apartment situation. There are video tape machines, low-cost hi-fi and television receivers, and all kinds of other devices that are susceptible to interference from amateur radio signals. It seems that the problem has multiplied in recent years because of two factors: the greater number of susceptible devices, and the general neglect of manufacturers when it comes to protection from strong electromagnetic fields.

The RFI problem takes a different, reversed form when consumer devices interfere with the radio amateur's communications. Home computers are notorious for this. Other devices, such as cordless telephones, can cause trouble as well. It seems that a double standard applies in the public mind for RFI: It's all right if the radio ham gets interfered with by a consumer device, but it's a cosmic catastrophe if it happens the other way around. It is not my place to say whether or not soap operas and video games are more important than radio communications of a hobby nature, but radio amateurs have to be prepared to face the facts.

In the event of a confrontation with neighbors, the American Radio Relay League, 225 Main Street, Newington CT 06111, (203) 666-1541, may be of assistance. They are familiar with legal cases that have occurred as a result of RFI.

My own attitude is that I won't operate if it interferes with some other person's activities. I don't consider myself that serious an operator. I'll reduce power or operate when nobody else is awake. But not everyone shares this tempered, retiring view. The most the ham can do is be certain that his transmitted signal is "clean"—free of harmonics or other defects in quality—and that he is running no more power than is necessary to carry out the given communications. This power issue is often overlooked: We hams tend to run more power than we need, most of the time. Apartment dwellers must keep constraints such as this in mind.

Many RFI problems can be cleared up by the installation of such things as line filters, better grounds, or different antenna systems. An indoor antenna is more likely to cause RFI than an outdoor one. There is some evidence to suggest that vertically-polarized antennas are more RFI-prone than horizontally-polarized antennas. A two-wire line must be kept in proper balance; a coaxial line must be free of "antenna currents" on the shield.

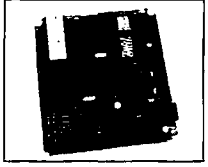
Further Ideas

The outdoor "invisible" end-fed wire and the indoor loop are the two antennas I have tried so far. Of course, there are other possibilities. A balanced "invisible" dipole, actually a shortened random V beam, is another scheme that might lend itself to my situation. This would be a set of two end-fed random wires, each of the same length, connected to opposite poles of the balanced transmatch output. Such an antenna would require no RF ground and would be balanced over a wide range of operating frequencies.

Perhaps the most interesting idea must wait until those long, cold winter nights, when the 1.8 MHz band comes to life. I find it hard to resist this band during those times. I figure if I'm not partying in Miami on those winter nights, the next best thing is a good cup of hot chocolate and an efficient antenna for 160 meters. I have used balloons and aluminum welding wire to make full-size "vertical" antennas of ¼ wavelength and longer on this band. Depending on the proximity of the utility lines, a scaled-down version of this idea might be used in an apartment *[Ed Note: Not recommended for apartment dwellers, it's best to try this in the wide-open spaces of the country. If you try this idea, make sure you are more than the length of your antenna wire away from any power lines, and don't try this on a windy night!]*. The balloon would have to be dark, so that it could not be easily seen at night, and it would have to be small enough to fit through the open window. Then there's the problem of getting the gas cylinder up three flights of stairs without provoking questions or getting a hernia. But, as the saying goes, when there's desire, there's no limit to what one can do. For a radio ham fond of the 1.8 MHz band, winters in the Upper Midwest have a way of cultivating desire. Let's see: a pound of that wire alloy 5356 with a 0.030-inch diameter is about 1,250 feet, so ¼ wave at 1.8 MHz, about 125 feet, would be only 0.1 pound, or 1.6 ounces. A 24-inch balloon would easily lift that, and ought to fit through the window with a little effort. Of course, I'd have to have the lights off so no one would see me climbing out onto the fire escape at midnight in below-zero weather with this two-foot balloon, but that's no problem. A little sign on the windowpane could remind me to switch off the lights before going out. . . 73

Contact Stan Gibilisco W1GV at 871 S. Cleveland Avenue, Apt. P-12, St. Paul MN 55116.

Natural Voice Products



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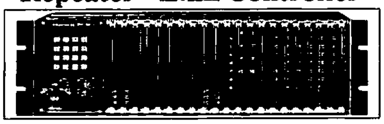

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Up to 4 different Remotes	+10v to +14v Supply
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CIRCLE 282 ON READER SERVICE CARD

Number 14 on your Feedback card

73 Review

by Dick Goodman WA3USG

The SR3 Simplex Repeater from Brainstorm Engineering

Versatile store-and-forward voice controller.

Brainstorm Engineering
3170 Beaudry Terrace
Glendale CA 91208
(818) 249-4383
Price Class: $330 with PL decoder installed; $230 without PL decoder.

The concept of a "simplex repeater" is quite simple. It is a voice store-and-forward device very similar to a packet digipeater. Additional hardware requirements are minimal—only one standard voice-grade radio and antenna is required for operation. The primary advantage to this type of repeater is in its simplicity. There are no duplexers, multiple antennas, external receivers, or auxiliary equipment needed. It can be installed in an automobile using an existing transceiver, driven to a high location, and put into operation immediately. It may even be used with a handie-talkie to provide portable repeater capabilities in a package considerably smaller than 1 cubic foot.

Sounds too good to be true, doesn't it? Well, it has a few disadvantages over a conventional repeater. Since it uses a single radio channel, it is a "half-duplex" device. The user keys his or her transceiver, speaks for a limited period of time, unkeys the transceiver, then hears the message repeated. The person that the user is communicating with would also hear this message and respond in the same manner. It's not really conducive to rag-chewing, but it is quite practical for applications where one or more people need to communicate but are out of range of each other. The simplex repeater can be centrally located, allowing everyone to communicate through it.

Photo A. The Brainstorm Engineering SR3 Simplex Repeater.

Until recently, simplex repeaters used either endless tape loops or standard cassette tapes as the voice storage media. While the user transmitted, the tape transport recorded the transmission. As long as the user had the transmitter keyed, the tape ran. When the transmitter was unkeyed, the transport went into a "rewind" mode, rewound the tape, and replayed the message. This caused a delay in repeating the original message, and it was a mechanically complex operation subject to problems. With the availability of inexpensive voice digitizing and storage devices, this inherent mechanical problem has been solved.

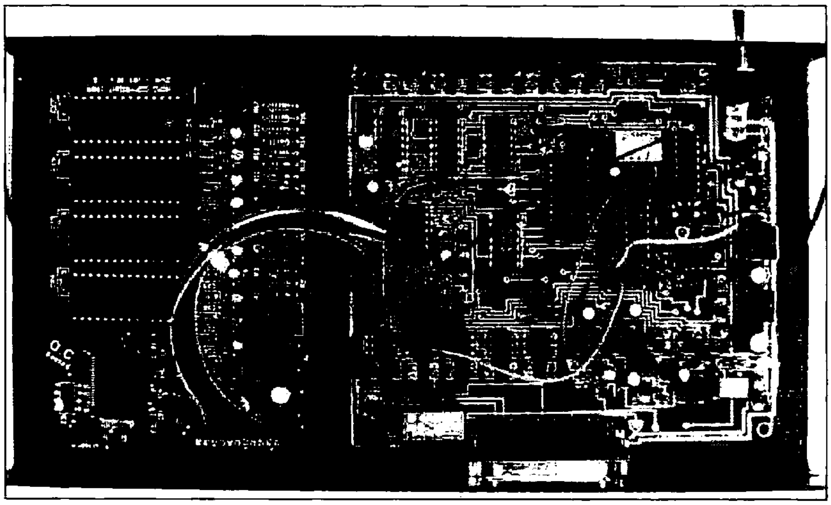

Photo B. Inside view of the SR3.

Enter the Brainstorm Engineering SR3 Simplex Repeater

The Brainstorm SR3 is packaged in a sturdy, all-metal case that you could almost drive a car over. Its dimensions are: 10.5" wide, 6" deep, and 1.75" high. It performs all the functions of a simplex repeater with none of the problems of the older, mechanical units. The power requirements are 11.6 to 15 VDC at approximately 200 mA. As well as functioning as a simplex repeater, it serves as a simple voice mailbox system, and a voice repeater IDer. All modes of operation can be controlled by DTMF tones.

The documentation that comes with the SR3 is excellent. It includes clear and concise specifications, operating instructions, and configuration data. The block schematics and circuit board layouts are high quality line drawings that are easy to read and will enable virtually anyone to interface the SR3 to a variety of radios.

Configuration, Setup and Operation

The front panel of the SR3 is simple and uncluttered. There are five "status" LEDs, and a power switch. All input and output to the SR3, including power, is via a DB-25 connector located on the rear panel. Brainstorm Engineering includes all connectors and cables necessary to get the SR3 up and running. Interfacing the SR3 to the radio is quite simple. Connections are made to the microphone audio input, the PTT input (the SR3 PTT line goes low at transmit), and the external speaker audio output. The SR3 has internal adjustment of both TX and RX audio levels. There are two versions of the SR3: the PL (Private Line) subaudible tone version, and the non-PL version. The unit reviewed here was the PL version, and I recommend it highly as it adds

considerably to the versatility of the unit.

As well as the connections to the radio identified above, the SR3 needs to know when a signal is being received by the radio connected to it. There are pins on the DB-25 interface connector that may be connected to any point in the radio that goes high (2–12 VDC) when a carrier is received. Many radios have "busy" LEDs that serve this purpose well. I used the "busy" LED on my Heathkit HW-2036 and it worked nicely. The problem with this is that the radio must be modified for this to work. Also, some of the newer rigs use an LCD "busy" indicator which may not have the correct voltage level for the SR3. If you have the PL version of the SR3, this is not a problem. Whenever the SR3 hears the correct PL tone from the user's radio it assumes that a carrier is present. The big advantages of this are that absolutely no modifications are required of the radio, and communication may take place on the SR3's frequency, without being repeated, by simply turning off the PL on the user's rig. The PL version will detect the presence of the carrier by either the voltage level or the PL method.

The SR3 is extremely reliable and easy to use. The three operating modes—"simplex repeater," "voice mailbox," and "voice repeater IDer"—can be enabled or disabled via DTMF input from the user. It should be noted at this point that only one mode may be used at a time. For example, if the SR3 is in the "simplex repeat" mode it cannot be a "voice IDer." The SR3 comes standard with memory for storage of 16 seconds of voice. A maximum of 64 seconds may be installed by adding additional SRAM chips.

The Simplex Repeater Mode

This is the mode that the SR3 defaults to after power-on reset. When the SR3 senses a carrier, it immediately goes into the "record" mode and stores the user's audio until the carrier drops. When the carrier is gone, the SR3 keys the transmitter and plays back the received audio. I found that after playing a bit with the RX and TX audio level adjustments, excellent audio quality could be obtained. I tried out the "voltage level" COR carrier detection technique in the shack and it seemed to work well. The PL carrier detection really shines, however. It worked quite reliably with all stations that tried it.

The Voice Mailbox Mode

This is a simple voice mailbox. It will store only one message at a time. If additional messages are entered, they will overwrite the original message. The mailbox mode may be entered via the proper DTMF code.

There are two ways to leave a message. In the first method, the user keys the transmitter, dictates the message and, without dropping the carrier, presses the correct DTMF key. The message is now stored and will be repeated any time the SR3 senses a carrier. The SR3 will not interrupt a QSO on frequency, but the message will be repeated each time a carrier is sensed and dropped.

In the second method, prior to dictating the message, the user keys the transmitter and enters the correct three-number DTMF code, states the message, and sends the correct two-digit DTMF code. This all must be done without unkeying the transmitter. Now the message will only be repeated upon receipt of the correct DTMF code from the recipient. This may sound complex, but it is relatively easy to master.

The Repeater IDer Mode

This is a simple but effective way to either voice-ID your conventional repeater, or to generate announcements of general interest. The SR3 contains a timer that may be set from about 10 seconds to 20 minutes. After loading a message or ID, the SR3 will output this message the first time the repeater is keyed. After this, the message will be disabled until the SR3's timer has reset. Upon completion of this reset, the message is enabled for transmission the next time the repeater is keyed. By sending the correct DTMF tone, the message may be generated at any time.

Other Features

The built-in DTMF decoder allows complete control of the SR3 remotely. Messages, IDs and voice mail may be entered and overwritten using the correct codes. The SR3 may also be taken completely off line via DTMF control. An additional feature is a DPDT relay option that can be user-installed. This lets you pick up or drop out a relay via DTMF control. Use the relay contacts for your own control purposes.

Other Uses

Tim Barefoot KA3ATH has been of great assistance in this review. He interfaced the SR3 into his home station. A number of guys in the Keystone VHF Club of York, Pennsylvania, played around with it. All three modes of the SR3 were exercised and worked well. Everyone was thoroughly fascinated with hearing their own voice being repeated back. The Keystone Club is in the process of putting up a 440 MHz/50 MHz linked repeater. We presently have the SR3 interfaced as a simplex repeater on the 6 meter side. It is interesting to drive around different areas of the county, store voice audio in the SR3, and play it back. It has told us a lot about the coverage that we expect to get from the repeater. We will probably try the SR3 on the 440 MHz side when we get it completely up and running.

I have experimented with sending SSTV audio into the SR3 on 2 meters with my Robot 1200. The audio back from it reproduced the original picture reasonably well. An SR3 placed in a central location would allow all members of a club to evaluate the operation of their rigs by allowing them to listen to their own signal coming back. Finally, an SR3 in your shack in the voice mailbox mode would allow you to leave a message for the XYL, even if she was not home at the time.

I found this device to be quite interesting and intriguing! There are many other uses for it, and one has to let his or her imagination set the limit. With the advent of inexpensive digital electronics, I hope that other products will be as innovative as the Brainstorm Engineering SR3 when they hit the market. ■

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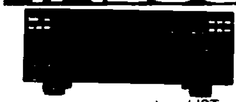

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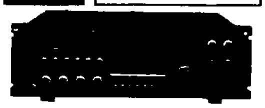

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Expedition News

A5 Bhutan. Jim VK9NS and Kirsti VK9NL are planning to operate from Bhutan, beginning around May 1. This will be the second operation for Jim, who signed A51JS last year.

US0UT. During February and March, Nick UB5UT was active from Lavrentiya with this special callsign. Lavrenliya is located just across the Bering Strait from the mainland of Alaska. For DXCC purposes, a contact with this station counts for the DXCC country of Asiatic R.S.F.S.R. (UA9/UA/0). QSL via Romeo Stepenenko, Box 812, Sofia 1000, Bulgaria.

UNSC8R1—Guyana. This is not a new type of antenna; it is the callsign of a new station operating from Guyana (8R1). The operator told K5OVC that this is the callsign typed on his license, and he is using it accordingly. It should probably be more like 8R1UNSC. QSL to Juan Larrabure, 42 Brickdam, Georgetown, Guyana.

Pirates. 3A0RA was a pirate. Don't waste your time or money sending a QSL to W4RA for a contact with him. Larry W4RA knows nothing about this station and is certainly not the QSL manager. 5X5GH, who also said to QSL via W4RA, is also believed to be bogus.

5A1DX was also a pirate; don't bother QSLing to W4BFQ for this one.

The station signing VU2TU/VU7 (Nicobar Islands?) appears to be a pirate. VU2RX is reported to have said that Indian regulations do not allow Indian stations to use a portable callsign. This station, if it had been legitimate, would have signed VU7TU.

XZ9A Burma. The persistent operation by XZ9A during February was the work of a pirate. The operator said to QSL via JA8IXM. JA8IXM knows nothing about this station.

QSL Notes

VK9MR and VK9LHI: Not via VK2WU. The manager for VK9MR (Mellish Reef) and VK9LHI (Lord Howe Island) is NOT the current license holder of the callsign VK2WU. The former VK2WU, who was the QSL manager for both stations, has moved, changed callsigns, etc., and evidently did not finish answering QSL card requests for either station. Does anyone know the whereabouts of the logs for these stations?

ET2A Ethiopia. There is a station on the air from Ethiopia! We've been getting bits and pieces of rumors during the past few months about a possible ET operation, but nothing worth printing. . . until February. The station is ET2A and the main operator is Jack W4IBB. Jack's wile and another operator named Scott may also operate the station from time to time. Jack has been trying to obtain a license for a year and a half!

There is a written license (which may be renewed), and by now it should have been forwarded to to the DXCC Desk. The station consists of a TS-140S transceiver and various antennas. Don't expect much, if any, CW activity from Jack, but Scott may give it a go. QSL via WB2WOW.

Publications for DXers

The ARRL has published a new book on DX. Mark AA2Z, ARRL Publications Manager, describes *The DXCC Companion: How To Work Your First 100 Countries*, by Jim Kearman KR1S, as: "Intended for new DXers. . .it covers the sport of DXing from making the first DX contact to applying for the DX Century Club (DXCC) award. Everything the beginner needs to know about antennas, propagation, working 'split,' sending QSLs, and working DX on nets and lists, is presented in a bright, humorous style."

KR1S's publication doesn't cover everything, but it is a fine publication, and it certainly contains most of the information the beginning DXer needs. It's informative, easy to read, and certainly a worthy addition to any new DXer's library.

You can order *The DXCC Companion*, a 129-page soft cover book, from the ARRL, 225 Main Street, Newington CT 06111. The cost is $6.00 (plus $2.50 for postage and handling; $3.50 for UPS).

A booklet, "Russian Phrases for Amateur Radio," is available from Len Traubman W6HJK, 1448 Cedarwood Drive, San Mateo CA 94403. The cost of this booklet is $5. A 90-minute cassette tape is available for $6.

Special Prefixes

1H0, 1C4, 1P1, etc. The "one" prefixes are unassigned, but several callsigns with the "one" prefix have been adopted for use by stations operating from the DXCC countries of the Spratly Islands (1S) and the Sovereign Military.

Order of Malta (1A0KM). "One" prefixes have also been used on a regular basis by American operators when on IOTA expeditions. For example: NE8Z/1C4 and K1RH/1H0 from one of the islands in the South Carolina Group (IOTA designator NA-110) and several Texans have used the 1P1 prefix from Pelican Island (Galveston, Texas). The use of the self-assigned "one" prefixes by U.S. operators is not illegal.

7S3OWG Olympic Winter Games 1998. The special callsign 7S3OWG will be used until June 15 by members of the Jentlands ARC (SK3JR) to promote Ostersund (Sweden's candidate for the 1998 Olympic Winter Games). QSL via SM3CVM. 73

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		PY0RC	via PY5SM
4U1ITU	ARRL DX CW (Feb.91) via N6TR	RA1AKB	Box 300, Kronshtadt City, 189610, USSR
8P6NX	via W0SA	RL7GEK	Box 1, Alma-Ata 480068, Kazakh, USSR
9H1EU	via WA4JTK		
9M6ET	via WB2KXA	RZ1A	P.O. Box 417, Leningrad 191011, USSR
9M6HF	via WE2K		
9M8GB	via DJ1UJ	T30DQ	via DL5UF
9M8RH	via DJ4OI	T30DR	via DL2GBT
9M8WB	via DK7UY	T30DS	via DJ9ZB
A71AM	via DJ9ZB	TA2/RF6FO	via WA2NHA
A71CD	P.O. Box 1007, Doha, Qatar	TG9CXM	via K3BYV
		TJ1BJ	via K4UTE
AT0NRO	via VU2APR	TJ1CW	via F6EEM
BY1BJ	Box 6111, Beijing, People's Republic of China	TJ1YL	via F6FYP
		TR8WJH	via G4TWT
C21JM	New: Jim Motiti, P.O. Box 359, Republic of Nauru, Central Pacific	TY2AB	via IK8DOI
		UZ3MWD	Dimitry Orekhov, P.O. Box 80, Jaroslavl 150000, USSR
CN8NY	Yousef, Box 6557, Rabat, Morocco	V63BH	via JA1UZI
		VE4GV/6Y5	via VE4GV
EL2SM	via SM3HML	VP2VM	Feb. 1991 via KU2Q
ET2A	via WB2WOW	VP2V/K5NA	via KU2Q
FY5FP	via ON4ZD	VP2V/KU2Q	via KU2Q
HH4TD	not via KP4NL	VQ9WM	via K7IOO
HR2BDC	Dean Cary, Box 7373 Eagle Pass, TX 78853	WA6VRS/DU3	Terrell Cohen, PSC 3, P.O. Box 15556 APO San Francisco CA (do not put call on envelope)
IS1W	via I1RBJ		
IU8A	via IK8DOI		
J6LTA	via NI4M		
JH0BBE/JD1	via JH0BBE	WE6C/BV2	via WU6X
JT8AA	Box 49, Altaj 050000, Mongolia	XF0C	via XE1BEF (Clarion Island)
		XV5XA	via JA1AH
K8MFO/6Y5	via W8TPS	YY5P	via YV5ARV
KB5NIV/DU4	via WA5ADH	ZC4MT	Box 413, Larnaca, Cyprus
KH0/JI3XRZ	via JF3KOZ	ZV7BI	via PT7BI
P29AC	via VK8AC	ZW0MI	via PY5TT (Mel Island)
P29DK	via KE4EW	ZX0MXK	via PY2MXK

ATV

Ham Television

Bill Brown WB8ELK
℅73 Magazine
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Hancock NH 03449

ATV in Space

When the STS-37 shuttle mission blasts off this April 4th, it'll be the second time an ATV receiver has been put into space. The first was the 1265 MHz receiver on the Webersat microsat. The next step? How about an ATV *transmitter* in space?

Project Excelsus

Students from Southeastern Community College in Whiteville, North Carolina, plan to launch their own space mission sometime in mid-May. Instructors Ben Frink and David Couvillon KC4WDW, along with Simms Spears, have put together a team of electronics and physics students who are busily assembling a very unique rocket/balloon (Rockoon) system.

The Rockoon

The students' ultimate goal is to launch a live *color* camcorder and an ATV transmitter to an altitude in excess of 50 miles (the beginning of space!). To accomplish this they are building a 10-foot long rocket (6 inches in diameter) which will carry a color camcorder and a PC Electronics KPA5-RC 1 watt ATV transmitter (439.25 MHz). A second transmitter on 1255 MHz FM TV (T.D. Systems) will send back pictures from a B/W camera. Even though they will be using a large Vulcan "M" size rocket motor, they could only reach a maximum height of a few thousand feet if launched from the ground. However, the plan is to fly the rocket up to 100,000 feet attached to a large plastic balloon (RAVEN model 52k). Since 100,000 feet is above most of the atmosphere, igniting their rocket from this point could send it up over 350,000 feet high.

Many government Rockoon flights have been flown to study the upper atmosphere. Some of these have made it well over 100 miles up.

The Rockoon consists of two separate packages, the rocket ATV system and the launch control platform. Telemetry from the platform is relayed down to mission control via a packet link designed by PacComm. The fire command is issued via this link which activates a special ignitor circuit. In addition, a third ATV camera and transmitter on 426.25 MHz will be located on the platform which will allow us all to monitor the rocket and watch the liftoff! There will be packet telemetry on 2m FM from the rocket as well as the launch platform. The final telemetry frequencies will be announced a few weeks before the flight.

Since the rocket won't achieve anywhere near orbital velocity, it will come back to earth as soon as it hits the maximum altitude. After ignition, the whole flight into space should only take a few minutes.

The Rockoon will be launched from the North Carolina shoreline and should drift about 50 miles out to sea before the rocket is fired. That way the rocket will return for a splashdown in the Atlantic. Several chase boats will be on hand to attempt a recovery.

Go Along for the Ride

Anyone within 400 miles of the launchsite should be able to receive the balloon transmission and watch the launch of the rocket. If the rocket makes it up to 50 to 100 miles, you may be able to watch spectacular views of space from over 700 miles away! At any rate, it ought to be quite a ride! For those of you using a *cable-ready* VCR or TV, you can tune in the rocket ATV transmitter on cable channel 60 and the control/ignitor camera on cable channel 58 (use a good vertically polarized 70 cm antenna for best results). An HF net will convene before and during the flight on 7.155 MHz with launch updates. It will also collect reception reports.

High Flying ATV at SCC

The Rockoon flight is the culmination of several

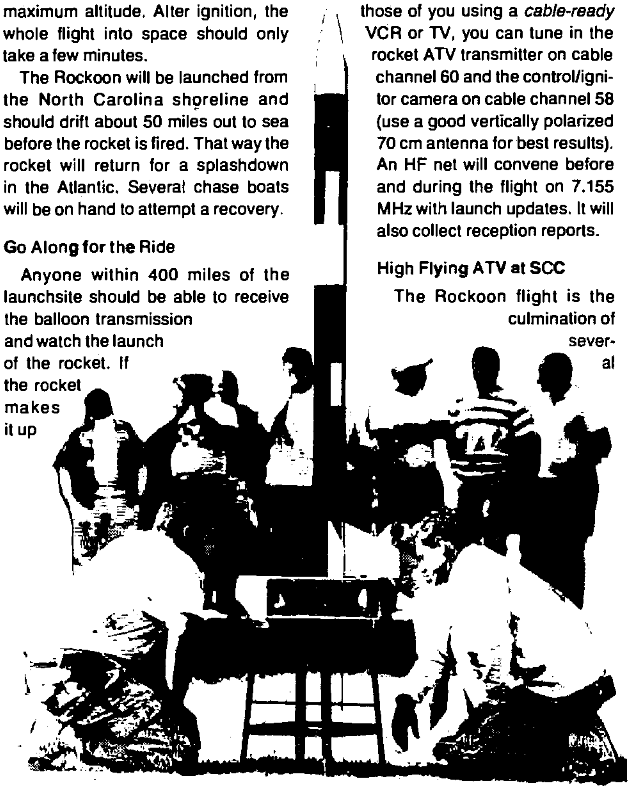

Photo A. The first SCC rocket ATV flight.

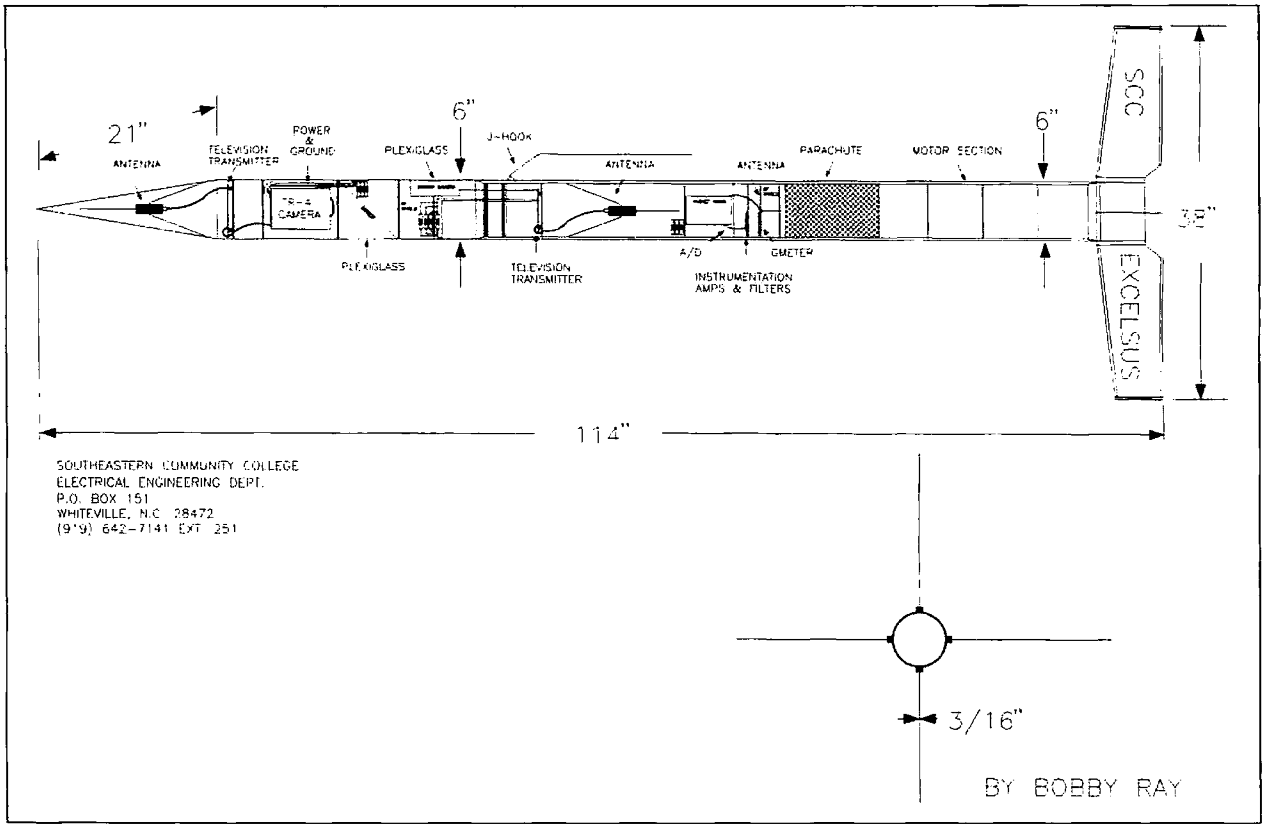

Figure. Diagram of the SCC space probe. Drawing by Bobby Ray.

Photo B. A few members of the launch team holding the first balloon payload. From l ro r: Simms Spears, David Couvillon KC4WDW, Ben Frink, Bob Rau N8IYD and Bill Brown WB8ELK.

west of the ocean. Although local Wilmington, North Carolina, radio club members gave it their best shot, it was nearly impossible to get any signal through the dense pine forests in the area. Fortunately, two days later, a local resident found the payload lying in a ditch on the side of a small road.

The SCC group hope that these ATV experiments will inspire other schools to develop projects of their own. It's a great way to learn electronics while doing something new and exciting.

Launch Info

Update . . . The cross-country manned ATV balloon flight covered in

Dayton HAM TV Activities

Plenty of ATV activities can be found this year at the Dayton Hamvention. Check out the Friday evening (7:30 p.m.–midnight) annual ATV PARTY at the Holiday Inn North (just off exit 57-B on Interstate 75). Since over 150 ATVers attended last year's party, this year it will be held in the Grand Ballroom (seats 300). Lots of great speakers, demos and, of course, ATVers from around the world. Quite a contingent from the BATC (British Amateur Television Club) plan to attend this year.

The ATV Forum will once again be

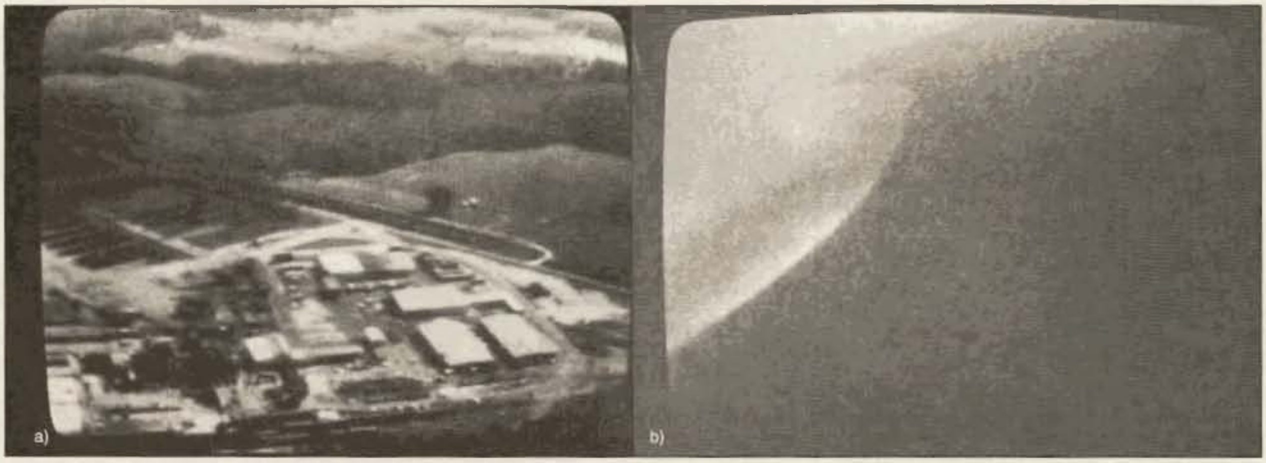

Photo C. Downlink video from the live camera payload. (a) the Georgia Pacific plant from 2000 feet. (b) 200 miles of the North and South Carolina coastline as seen from 65,000 feet.

airborn experiments that students at Southeastern Community College have performed. Their first flight consisted of a 4-foot model rocket with an HVM-322 camera and a TV transmitter which the students designed in their electronic engineering techology class. This flight was launched last May from the campus parking lot up to about 800 feet. When the camera popped out of the fuselage, you could see the crowd of onlookers getting closer and closer as the package parachuted back down. It was great to see the smiling face of the lucky student who caught it before it hit the ground!

The class became inspired by their initial success and invited Bob Rau (rocketeer) and me (balloonatic) down to help them launch their next payload on a high-altitude balloon. Just after noon on October 23, their live camera ATV payload was launched from the SCC campus attached to a 5-foot weather balloon. The class gathered around the ATV receive station at mission control (the electronics lab), fascinated by the spectacular views of the North and South Carolina countryside coming down from the balloon system. At 65,000 feet nearly 200 miles of the Atlantic coastline could be seen. Thanks to the efforts of Hap Griffin WA4UMU, visitors to the ATV booth at the Sumter, South Carolina, hamfest were watching as well. In addition, Fred Tuck WD4KTI and Don Fortner K4SAO had good reception from Inman, South Carolina (200 miles). One of the most amazing reception reports came from Ken Gallagher W3DFS in Adelphi, Maryland (350 miles away) who reported a completely snow-free P5 signal for about 10 minutes!

After the balloon burst, the package parachuted down to land just 8 miles

last March's column has been postponed until September. Look for further information and updates about this flight and Project Excelsus via AMSAT bulletins (both the nets and packet BBSs) as well as the Tuesday night ATV net on 3.871 MHz (8 p.m. Eastern time).

chaired by Tom O'Hara W6ORG at O'Hare arena on Saturday afternoon. Look for talks by Tom W6ORG, Carole Perry WB2MGP, Dave Baxter W5KPZ and myself.

While at Dayton, listen in to the action on either 144.34 MHz or 147.45 MHz. SEE you all there! 73

Photo D. Southeastern Community College students hard at work building the Excelsus *rocket. l to r: Jan Knotts, Bobby Ray, Marty Scott, Chris Gilliard, Tim Andrews and Chris FormyDuval.*

Number 19 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
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Staten Island NY 10313-0006

An Invitation to 4U1UN

Most of us would agree that any 8th grader should be able to speak intelligently about the United Nations, its background, and its role in the world today. Imagine my surprise at learning that only 20% of my 400 students in the 6th, 7th, and 8th grades could even identify the world famous profile of the UN Building at 42nd Street in New York City! My incredulity grew as I discovered that most of them didn't realize that we, in Staten Island, were within 45 minutes of the UN Complex.

You can hardly open a newspaper or listen to a TV news broadcast without some visual representation of the UN in the background. The world crisis centering around the Persian Gulf, and the recent role of the General Assembly, should have prompted provocative discussions in every school in the country. It is appalling to think that so many youngsters have disfranchised themselves intellectually from discussions or opinions about world events. The responsible adults among us should point out that it's their future hanging in the balance, too, and that they have an obligation to be well-informed about the decisions that world leaders are making.

We often get involved in discussions on current events as a direct result of contacts we make on the radio to different parts of the world. The teacher of an amateur radio course can easily bring in topics from other studies to the classroom. I was especially delighted, therefore, when I received an invitation to visit the United Nations amateur radio station, 4U1UN. This would be a great opportunity to bring information about this world body back into the classroom in a meaningful and exciting way.

I shared my feelings of excitement with the children. Suddenly, students were telling me what they'd heard about the UN on the news on TV, and they began bringing in newspaper articles about the General Assembly and the Security Council.

On Tour at the United Nations

When the big day arrived, I was given a list of questions prepared by the children in their social studies classes. Their teachers were delighted with the interest, and it was gratifying to me to be part of a team effort in education.

Upon my arrival at the UN, I was met by David Rosen K2GM, the station manager of 4U1UN. David was my gracious host for the day. During a wonderful lunch at the UN restaurant, we spoke about the background and history of the UN.

The UN is an international organization of sovereign nations, established to serve the cause of peace. According to its Charter, the UN attempts to do this through political action, such as mediation or prevention of conflicts among nations, and promotion of higher living standards through economic and social action. Its purpose is to develop friendly relations and cooperation among nations, and to serve as a center for harmonizing international action.

Since 1941, the UN has had several different sites. In 1946, the General Assembly accepted $8,500,000 from the American philanthropist John D. Rockefeller, Jr., to purchase a 16-acre site bordering the East River between 42nd and 48th Streets in Manhattan. Later the site was granted extraterritoriality status under the Headquarters Agreement concluded between the UN and the U.S. on June 26, 1947. Plans for the famous UN Complex were drawn up under the guidance of American architect Wallace Harrison, and unanimously adopted by the General Assembly in November 1947. The cornerstone was laid on UN Day, October 24, 1949, and work was completed by the middle of 1952.

The four main buildings are the General Assembly Hall, the Conference Building, the Dag Hammarskjold Library, and the Secretariat Building, which houses the amateur radio station 4U1UN.

In 1946, the UN adopted its official emblem, a map of the world seen from the North Pole, surrounded by two wreaths of olive branches. The UN flag, adopted in 1947, displays this emblem in white, centered on a light blue background.

Station 4U1UN

After an extremely informative tour of the complex, we spent several hours at 4U1UN. UN staff from all over the world, such as Panama, Sri Lanka, and Poland, comprise the UN Amateur Radio Club, of which Raymond East KB2BKO is president.

In order for the station to assist more efficiently, a special group of volunteers has been organized. The group consists of both amateurs and nonamateurs from the UN staff. Since 1986, 4U1UN and this support group have participated in 11 disaster operations.

Most importantly, the group has expanded to include a growing number of amateur stations outside of Headquarters who work closely with 4U1UN during crises. Most of these stations have been prominently involved with emergency activities in the past; they include WA1KKP, VP2MO, NP2CM, W8CZN, OA4OS, VS6VO, W9ARV, and K2EWB. Many other stations have recently joined the activity.

David emphasized that the Radio Readiness Group is entirely an amateur radio undertaking, and that stations interested in assisting 4U1UN when the normal channels of communications have been severed, are welcome to call in.

During disasters, when amateur communications are required, the net will meet on specified frequencies. The principal frequency is 14.268 MHz, with 14.168 as an alternate (traffic is also handled on other alternate frequencies as specified at the time). Other frequencies are 3768/3868/7068/7268/21368/28468.

During disasters, 4U1UN has been in liaison with relief agencies and other official entities. One such agency is UNDRO. "The United Nations Disaster Relief Organization" acts as a coordinator in the provision of aid to stricken areas. During emergency periods, 4U1UN has furnished UNDRO with post-event information about catastrophes. Situations involving hurricanes, volcanoes, and earthquakes are all helped by the rapid relaying of information by the amateur community.

Between the UN Headquarters-based Radio Readiness Group, with all of their area and language expertise, and the dedicated efforts of the Radio Readiness Group with the assistance of amateurs worldwide, it is hoped that 4U1UN and the Radio Readiness Group can make a difference.

David offered these priorities:

1. To address the emergency requirements in the disaster area as it pertains to the preservation of life.

2. To determine in a precise manner the extent of damages and needs—e.g., medicine, food, and shelter.

3. To optimize activities to be of the most value to the stricken area requires organizing the Headquarters and on-the-air group so that both elements may efficiently respond.

4. To efficiently expedite health and welfare traffic.

Members of the 4U1UN station feel that their amateur radio efforts meet the principles of the founding countries of the UN. It embodies what the nations of the world expected of the UN when they founded it.

They hasten to add that emergency support activities are also prioritized by all the amateur radio service, and they acknowledge the good work other emergency nets have done.

David pointed out that Resolution No. 640: Relating to the International Use of Radiocommunications in the Event of Natural Disasters, in Frequency Bands Allocated to the Amateur Service (WARC 1979) has now been incorporated into the amateur regulations of several telecommunication administrations.

On the roof, there is a wonderful array of antennas, including a Hy-Gain TH4, a Cushcraft 103CD, a Create CL 10DX 6-element 10 meter beam, dipoles for 40 and 80 meters, and a DX-88 7-band 10-80 vertical. A ruggedized Telrex 20M536 5-element, 20 meter beam is on hand and awaits installation. At the station, which I had the pleasure of working that day, is a Kenwood TS-940S and a Kenwood TL922A amplifier. David said their objectives are to install equipment sufficient to allow 4U1UN to operate on several bands simultaneously.

My visit to the UN was a personal treat for me, and also provided the opportunity to bring world events into the classroom through amateur radio. Peace through communications should be a goal for us all.

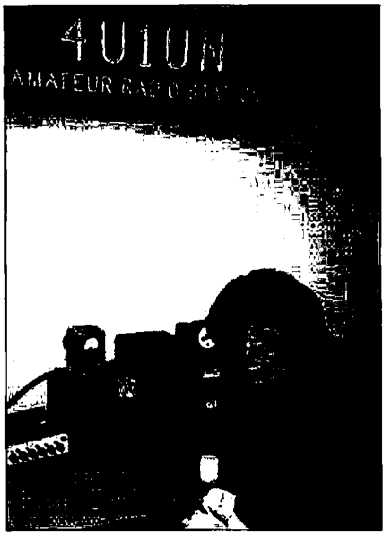

Photo A. Carole Perry WB2MGP, enjoying working 4U1UN.

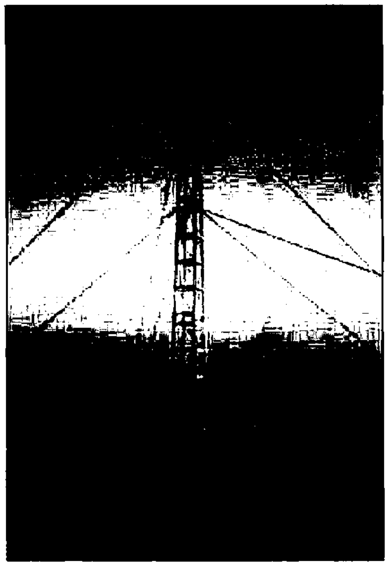

Photo B. David Rosen K2GM, station manager of 4U1UN, stands beneath the 4-element yagi on the UN building's roof.

Number 20 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
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RS-14

RS-14 is up and active. It's hard to believe a 200 mW satellite beacon can be loud enough to be detected on any 2 meter antenna with almost any 2 meter receiver. Launched on January 29 of this year, RS-14, also known as RADIO-M1, RUDAK-2, or, as I intend to refer to it, AMSAT-OSCAR-21, has been sending CW telemetry on 145.822 MHz since February. The German-made digital experiment has also been energized for tests, and the linear transponders should be active by the time this column is printed.

In early 1989 Leonid Labutin UA3CR met with Hans Peter Kuhlen DK1YQ and other members of AMSAT-DL (West Germany) to propose a joint effort in the design and construction of an amateur radio satellite. Leo represented the AMSAT-U-ORBITA group and the Moscow Adventure Club, both of the U.S.S.R.

The groups agreed to work together on the program, and to design and build their portions of the satellite in time for a scheduled launch only six months away. The electronics would become a physical part of a Soviet geological research satellite called GEOS.

The Soviet group AMSAT-U-ORBITA worked primarily on the linear transponders and associated telemetry systems. They named their part of the system RADIO-M1. The "M" represents the cities involved in the program: Molodechno, Minsk, Moscow and Munich.

The Soviet's CW telemetry comes down at 20 words per minute, and you can hear it on any portable, home, or mobile 2 meter rig capable of CW/SSB reception. In between the eight groups of four digits each, the satellite identifies itself as RS-14. From home stations, the only obvious way to tell that the signal is not from a nearby transmitter is to listen to the Doppler shift on the signal's frequency as the satellite passes overhead. See Table 1 for frequency data. This is an updated version of the chart presented in the July 1990 "Hamsats."

The German contingent built a new version of their RUDAK experiment. RUDAK is a German acronym for "Regenerative Umsetzer fur Digitale Amateurfunk Kommunikation," or "Regenerative Transponder for Digital Amateur Radio Communications." The prototype RUDAK system worked for over two years from the top of a water tower in Ismaning, near Munich, Germany. The first flight-ready RUDAK system was a part of AMSAT-OSCAR-13, but it had minor wiring problems that had a disastrous impact. The experiment was never completely activated.

RUDAK is a complex packet store-and-forward system capable of input and output via many modes and data speeds. The original system was designed for high elliptical orbits where the satellite is in the sky for long periods. It was designed to rely on real-time digital communications (digipeating) with less emphasis on store-and-forward techniques.

RUDAK-2 on A-O-21 is in a low orbit, similar to the microsats. It is available several times a day, but only for short periods. This new version of RUDAK is built for bulletin-board features and other experiments that lend themselves to short access periods with much less emphasis on the digipeating capabilities.

Many signal types could be heard on the RUDAK-2 downlink frequency during initial tests from space. On February 25, stations around the world were surprised to hear speech on the RUDAK-2 output of 145.983 MHz. In a clear voice, with a slight touch of European accent, RUDAK announced, "I'm completely operational and all my circuits are functioning perfectly." This message repeated continuously for several orbits. On other occasions, very-high-speed data could be heard. It sounds like hissing over a span of several kHz.

The RUDAK system supports FSK (frequency shift keying), BPSK (biphase shift keying), RSM (rectangular spectrum modulation) and DSP (digital signal processing) operation. The DSP system works with any input or output for which programs have been created and activated in the spacecraft computer. This includes digital rates to 25K

Table 1. RADIO-M1/RUDAK-2 Data Sheet

Orbit Configuration

Polar circular orbit with average height 980 km (610 miles), inclination 83 degrees, period 104 minutes. Attached to GEOS, a Soviet geological research satellite. Launched in late January 1991 (from AMSAT-DL and AMSAT-U).

Frequency Guide

	Linear Transponder 1	Linear Transponder 2
Mode B Uplink	435.102–435.022	435.123–435.043
Mode B Downlink	145.852–145.932	145.866–145.946
CW Beacons	145.822	145.948
PSK Beacons	145.952 (1200 bps)	145.838 (1200 bps), 145.800 (1100 bps)

Regenerative Transponder RUDAK-2

Uplink	RX-1	RX-2	RX-3a	RX-3b	RX-4	Unit
Frequency	435.016	435.155	435.193	435.193	435.041	MHz
Speed	1200	2400	4800	9600	DSP	bps
Modulation	FSK	BPSK	RSM	RSM	any	
Coding	NRZIC Bi−Ø−M	Bi−Ø−S Bi−Ø−M	NRZIC NRZ-S+scrambler	NRZI	I+Q	

Downlink 145.983 MHz with 3 Watts typical (10W optional)

Mode 1: 1200 bps, BPSK, NRZI (NRZ-S) (like FO-20)
Mode 2: 400 bps, BPSK, Bi−Ø−S (like OSCAR-13 beacon)
Mode 3: 2400 bps, BPSK, Bi−Ø−S (planned for OSCAR-13)
Mode 4: 4800 bps, RSM, NRZIC (Bi−Ø−M)
Mode 5: 9600 bps, RSM, NRZI (NRZ-S) + Scrambler
Mode 6: CW keying (only for special events)
Mode 7: FSK (F1 or F2B), i.e. RTTY, SSTV, FAX, etc.
Mode 8: FM modulated by D/A signals from DSP (speech)

Technical Data

DC Power
Total system: 40W maximum
RUDAK-2 power consumption: 14V @ 350 mA (max) = 4.9W
Standby: 80 mA (RUDAK without power amplifier)
RF Output Power
CW Beacons (L/H): 0.2/0.4W
Digital Beacons (1200 bps/1100 bps): 0.4/2.0W
Transponders: 10W maximum
RUDAK-2 (L/H): 2/10W (3W typical)

Table 2. Radio-M1/RUDAK-2 PSK
Telemetry decoding information.
Digital-Telemetry of "RADIO-M1"
by AMSAT-U (RC2CA/UA3CR)
and AMSAT-DL (DG2CV/DB2OS)

Digital telemetry consists of 30 parameters + 2 constants. To receive the digital telemetry, you must use an FM receiver, a modem, a de-scrambler, and a personal computer.

Digital Telemetry Equations

Line	Parameter	Formula	Unit
1	Transponder #1 HF output pwr	0.2N	Watt
2	Transponder #1 PA temperature	0.8*N	deg. C
3	DC/DC converter temperature	0.8*N	deg. C
4	+14V Regulated	10*N	Volt
5	+24V Regulated	10*N	Volt
6	+16V Regulated	10*N	Volt
7	+12V Regulated	10*N	Volt
8	+9V Regulated	10*N	Volt
9	+7.5V Regulated	10*N	Volt
10	+5V Regulated	10*N	Volt
11	+9V Regulated (linear)	10*N	Volt
12	+9V Regulated (digital)	10*N	Volt
13	Service	N	•
14	Service	N	•
15	Transponder #2 HF output pwr	0.2*N	Watt
16	Transponder #2 PA temperature	0.8*N	deg. C
17	+24V Regulated	10*N	Volt
18	+16V Regulated	10*N	Volt
19	+10V Regulated	10*N	Volt
20	+9V Regulated	10*N	Volt
21	+7.5V Regulated	10*N	Volt
22	Status command link 1	•	•
23	Status command link 2	•	•
24	Status command link	•	•
25	Status command link	•	•
26	RPC +5V for Rudak-1	2.47*N	Volt
27	RPC +5V for Rudak-RTX	2.47*N	Volt
28	RPC +5V for Ramdisk	2.47*N	Volt
29	RPC +14V total supply current	627-289*N	mA
30	RPC module temperature	56.7*N-49.5	deg. C
31	"Zero" of the comparator	0C	
32	Reference voltage	6D	

$N = \frac{(i-0C)*1.16}{6D-0C}$ where 'i' is the parameter value in hex format.

or $N = \frac{(i-12)*1.16}{96}$ where 'i' is the parameter value in decimal format.

RPC—Rudak Power Conditioner

bps, voice, and other modes not yet invented.

The linear transponders were not activated for use early in the satellite's life, but with several watts available for transponder activity, A-O-21 promises to be extremely easy to work. The transponders, configured in Mode B, are inverting. A 70cm lower-sideband uplink signal is retransmitted on upper-sideband. Similarly, a signal sent in the lower portion of the uplink band will be heard high in the 2 meter downlink span. Omnidirectional antennas will be sufficient for those wishing to use the satellite.

Decoding A-O-21 telemetry provides insight into the satellite's systems. While the equations for the CW data have not yet been released, the digital telemetry can be deciphered with data from Table 2. The 1200 bps (bits per second) PSK beacons can be translated by PSK/packet systems capable of receiving Fuji-OSCAR-20's digital mode or the microsat downlink signals.

The 1100 bps transmissions are not as easy. Although this signaling rate is a standard in the Soviet Union, it is nonexistent in the U.S. A DSP (digital signal processing) device with a modem program for 1100 bps PSK is the best alternative.

RS-12/13

On February 5, 1991, one week after the launch of RS-14/A-O-21, Cosmos 2123 went to orbit. It is a replacement for Cosmos 1655 which has been operational since May 30, 1985. The new Cosmos is a civilian navigation satellite and incorporates RS-12/13 into the main power bus. The older satellite did not require replacement as early as previously anticipated, so launch was delayed for over a year.

Table 3 shows an updated version of the amateur radio frequency chart that originally appeared in the September 1989 "Hamsats." Like RS-10/11, RS-12/13 has three main modes and associated ROBOT autotransponders. Frequency bands have been offset to avoid interference with RS-10/11, but otherwise the new system is identical.

Table 3. RS-12/13 Frequency and Data Sheet

Orbit Configuration

Polar circular orbit with average height 980 km (610 miles), inclination 83 degrees, period 104 minutes. Attached to Cosmos 2123, a Soviet navigational satellite (NAVSAT). Launched in February 1991 from Soviet command station RS3A.

	RS-12	RS-13
Frequency Guide		
Mode A Uplink	145.910–145.950	145.960–146.000
Downlink	29.410–29.450	29.460–29.500
Mode K Uplink	21.210–21.250	21.260–21.300
Downlink	29.410–29.450	29.460–29.500
Mode T Uplink	21.210–21.250	21.260–21.300
Downlink	145.910–145.950	145.960–146.000
Mode KA Uplinks	21.210–21.250	21.260–21.300
	145.910–145.950	145.960–146.000
Downlink	29.410–29.450	29.460–29.500
Mode KT Uplink	21.210–21.250	21.260–21.300
Downlinks	29.410–29.450	29.460–29.500
	145.910–145.950	145.960–146.000
Beacons	29.408–29.454	29.458–29.504
	145.912–145.959	145.862–145.908
Autoanswer ROBOT		
Modes	A, K, T, KA, KT	A, K, T, KA, KT
Uplink	21.129 and/or 145.831	21.138 and/or 145.840
Downlink	29.454 and/or 145.958	29.504 and/or 145.908
Technical Data		
DC Power		
All system OFF	4.6W	3.5W
All system ON (max)	35W	25W
RF Output Power		
Beacon and Robot (L/H)	0.45/1.2W	0.45/1.2W
Transponder TX	8W	8W

During the first few days of life in orbit, RS-12 and RS-13 systems were checked for proper operation. Tests were going well until the Cosmos 2123 150 MHz transmitter began interfering with the RS-12 2 meter receiver. Digital signals heard within the RS-12 10 meter downlink were obviously not of an amateur origin. Efforts have been underway by command stations to circumvent this problem. If the satellite's 2 meter receive predicament continues, RS-13 may be activated, or Modes K (15 meters up and 10 meters down) or T (15 meters up and 2 meters down) on RS-12 may be turned on instead.

Mode A operation requires an uplink signal, either CW or sideband, within the passband limits on 2 meters. Ten watts to a home station omnidirectional antenna does the job on most passes. A 10 meter receiver with a MOSFET preamp and dipole will work for the downlink.

The 10 meter downlink resides just above 29.4 MHz. Interference from terrestrial FM stations is very common in this portion of the band. Many hams are not aware of the internationally accepted satellite downlink band limits of 29.3 to 29.51 MHz. FM receivers can barely detect the presence of the weak sideband and CW signals from the satellites. An uninformed FM operator with a strong signal can wipe out several satellite conversations and not even notice that a serious problem exists. The ARRL "Operating Manual" clearly defines the 10 meter band plan with extracts from the ITU (International Telecommunications Union) Radio Regulations Table of Frequency Allocations.

Mode K with its 15 meter uplink and 10 meter downlink is a mode where many newcomers make their first satellite contact. Although it is difficult to avoid interference between a 21 MHz transmitter and a 29 MHz receiver at a home station, it is possible. Many have done it. Transmit and receive antennas must be kept segregated to avoid receiver overload. Coax cables should be of good quality and kept apart. Finally, transmitter power on the 15 meter uplink should be only enough to make contact through the transponder. There is no band plan for 15 meter satellite operation. When calling "CQ," specify "satellite" or "RS."

Interference between the 15 meter transmitter and 2 meter receiver is rarely a problem for Mode T activity. The downlink signals are easy to copy, but there is a problem with this mode for U.S. amateurs. The transponder limits on RS-10/11 allowed Novice class operation, but RS-12/13 does not. Only Advanced and Extra class hams can use Mode T via RS-12/13. Those with an Extra class license can use sideband or CW anywhere within the transponders, but Advanced class hams must avoid operation below 21.225 MHz. Consider upgrading!

Even with license limitations, RS-12/13 offers exciting satellite communications. Together with A-O-21, the scope of amateur satellite activity has been dramatically increased with these new resources launched from the Soviet Union.

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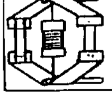
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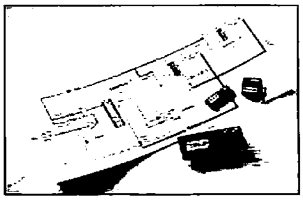


ISD

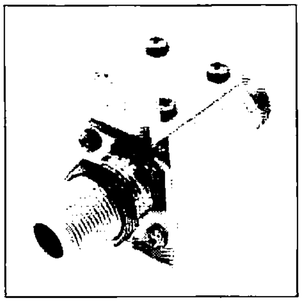
ISD has introduced the world's first implementation of non-volatile analog storage on a chip. The ISD1016, a single-chip voice messaging system, offers up to 16 seconds of telephone-grade voice recording and playback. With the addition of a microphone, speaker and just a couple of resistors and capacitors, you have an audio recorder on a chip! Applications can range from simple repeater IDs to voice mailbox systems. Multiple ICs can be cascaded for additional storage time. Twelve-second and 20-second versions are available as well (ISD1012 and ISD1020). The ISD1016 represents an exceptionally tiny solution with a miniscule energy budget, true zero-power nonvolatile storage array and extremely easy-to-use features.

For prices and more information, contact *Information Storage Devices, Inc., 2841 Junction Avenue, Suite 204, San Jose CA 95134; (800) 825-4473, (408) 428-1400, FAX (408) 428-1422.* Or Circle Reader Service No. 201.

POLYPHASER

PolyPhaser Corporation has added a new series of Nuclear Electro-Magnetic Pulse (NEMP) lightning suppressors to their popular line of coax protectors. The IS-NEMP series has threaded type "N" connectors standard on all equipment port interfaces. They handle up to a maximum surge of 50,000 amps with a $\leq$ 1.25 ns turn-on time, and 330 VDC voltage. They also have multi-strike capabilities, $\leq$ 1.1:1 VSWR, $\leq$ 0.1 dB IL, and throughput energy of $\leq$ 30μ Joules (based on 1 kV/ns waveform).

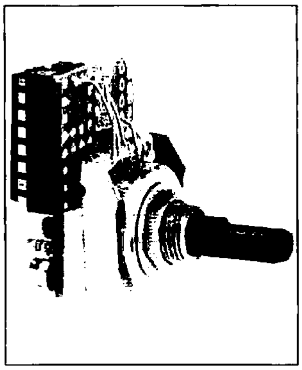
For prices and more information, contact *PolyPhaser Corporation, P.O. Box 9000, Minden NV 89423-9000; (800) 325-7170 or (702) 782-2511.* Or circle Reader Service No. 202.



COMMUNICATIONS SPECIALISTS

Communications Specialists is offering a miniature multi-tone encoder that permits selection of a discrete CTCSS or burst tone from a custom 12 (Model SS-12) or 16 (Model SS-16) tone memory. The tone is activated by a rotary encoder switch mounted on the board. In place of the usual DIP switch found on the old SS-32P encoder, these new boards have a 12- or 16-pole rotary encoder switch mounted on the bottom of the board. Up to 12 or 16 tones of your choice are programmed into the EEPROM before shipment, and can be changed later at no charge. The small size (1.3" H x 0.9" W x 0.73" D) allows for panel-mount installation in most base stations and many mobile radios.

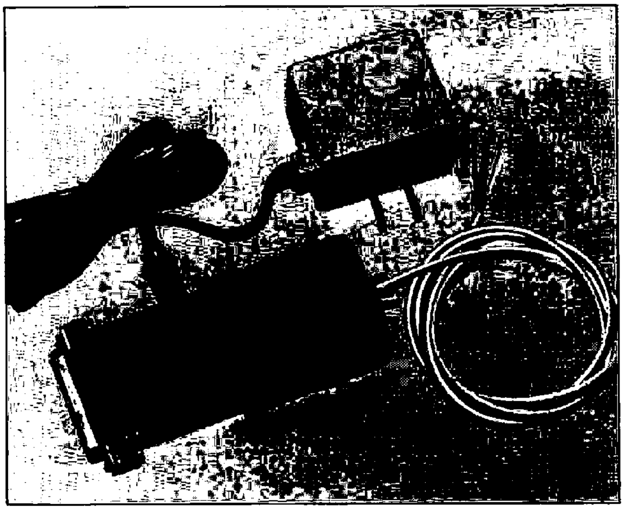
The SS-12 and SS-16 are priced at $39.95 each. Contact *Communications Specialists, Inc., 426 West Taft Avenue, Orange CA 92665-4296; (800) 854-0547, (714) 998-3021, FAX (714) 974-3420.* Or circle Reader Service No. 207.



EDWARD OROS

Edward Oros has released a conversion kit for the Uniden HR2600 and 2510 10m band radios, allowing them to transmit on 12m, making them dual-banders. The "Plus 12" conversion kit is easy to assemble and install—no drilling required! The total conversion time is less than one hour. All required parts and instructions are supplied with the kit.

The kit sells for $49.95, plus 6% sales tax for PA residents. Group discounts are available. Contact *Edward Oros, 2629 Sapling Dr., Allison Park PA 15101.* Or circle Reader Service No. 203.



DELTA RESEARCH

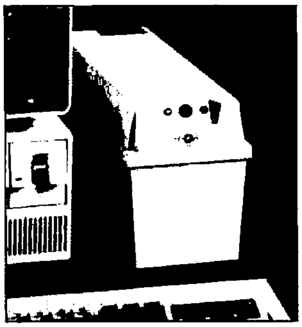
Delta Research has introduced DELTATONE 2.0™, the perfect complement to your repeater controller. The DELTATONE interface (hooks up to your computer's printer port) and your MS-DOS computer offer unlimited 16-digit DTMF tone generation for local or remote programming of the repeater controller. DELTATONE has three programmable tone speed settings. It accepts programming information from a control file created on your favorite PC word processor. Commands and comments can be freely mixed within the file. Its command language allows complete flexibility of tone selection, three sending speeds, selectable one-second delay between digits, a pause (tone off) until a key is pressed and, for level calibration, it will hold the last digit on until a key is pressed. It also has Morse code identification capability.

DELTATONE 2.0 is priced at $149, plus shipping and handling. Contact *Delta Research, P.O. Box 13677, Wauwatosa WI 53213; (414) 353-4567.* Or circle Reader Service No. 205.

TRIPP LITE

A new, compact UL-listed battery backup system from Tripp Lite, featuring 450 VA of power and LAN compatibility, offers superior performance for PC work stations. The BC-450 LAN Battery Backup System is UL-listed under UL-1778 (UPS systems) and supplies 450 VA of continuous power while providing complete spike, line noise and RFI/EMI filtering.

The BC-450 LAN, priced at $449, is part of Tripp Lite's new family of small UL-listed battery backup systems, also available in 275 VA and 375 VA sizes. Contact *Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188; (312) 329-1777, FAX (312) 644-6505.* Or circle Reader Service No. 206.



CHIPSWITCH

The CHIPSWITCH is designed to expand the existing features of the Uniden HR2510/HR2600/LINCOLN 10m radios. It features 30 memory channels with temporary channel lockout and repeater offsets, programmable SCAN/SEEK function, programmable channel UP/DN buttons, programmable microphone UP/DN buttons, programmable transmitter timeout, split frequency operation, programmable transmit frequency range, and priority channel operation (requires additional hardware).

CHIPSWITCH retails for $59.95, plus postage, including the Operator's Manual and Installation Guide. An optional chip socket ($7.50) and priority channel board ($29.75) are also available. Contact *CHIPSWITCH, 4773 Sonoma Hwy., Suite 132, Santa Rosa CA 95409-4269; (801) 224-4130.* Or circle Reader Service No. 204.

THE GRAPEVINE GROUP

The Grapevine Group's new catalog of computer parts and accessories includes the hard-to-find spare parts and upgrades that Commodore C-64 owners need. This 34-page catalog comes in two editions: one for end users, and one for dealers.

Contact *The Grapevine Group Inc., 3 Chestnut Street, Suffern NY 10901; (914) 357-2424, (800) 292-7445, FAX (914) 357-6243* Or circle Reader Service No. 208.

Number 22 on your Feedback card

UPDATES

International Radio and Computer, Inc.

Robert A. Pohorence, President of the above company, writes: "We have closed our operation at the Port St. Lucie location and consolidated our business and personnel at our new headquarters in Fort Pierce. The new address is 3804 South U.S. 1, Fort Pierce FL 34982. The telephone numbers are (407) 489-5609 and 879-6868; the FAX number is (407) 464-6386. Also, as of January 1, 1991, International Radio and Computer, Inc., bought the Fox Tango trade name and assets."

C-64 & 1541 Drive 12V Conversion

John Neeley K6YDW writes: "Following is an update on my article, "C-64 & 1541 Drive 12V Conversion," that appeared in the July 1990 issue of *73*, pages 26–30.

"1. Ramsey Electronics no longer carries the TB-6 60 Hz Time Base kit. If you need it for the project, you can build the home-brew version in Figure 3.

"2. In some instances, depending on the terminal program or TNC you use, this 60 Hz clock is not required. Do the power wiring conversion first, then try it out to see whether this is the case. The clock is probably not required if you don't use the disk drive, such as when you use the AEA PK-88 and Digi-Cart programs. This was brought to my attention by readers who did the conversion."

More on the Frequency Standard

Refer to the article, "High Precision Frequency Standard," by Johnson in the January 1991 issue, and the March "Updates" on same. Edward E. Burkhardt of WRTV: "Paul: Typical expected Doppler shifts of domestic geostationary satellites cause frequency shifts in the order of 1 x 10^{-8} which result in color burst changes of 0.03579 Hz from the origin point—not 'about 1 Hz.'

"Even in Los Angeles or New York, color burst can be used only if the station's frame synchronizer is also tied to the atomic standard.

"You [Paul] mentioned your station is locked to WWV 60 Hz as a condition of license. The 60 kHz calls are WWVB. Phase-locking to WWVB results in frequency errors on the order of 1 x 10^{-8} during daytime propagation changes. Please tell me more about your 'condition of license' to be locked to WWVB—this is a new one to me.

"Brad: You should not have used the word 'percent' in '2.79 x 10 to the minus 6th percent'. Rather, it should read, '2.79 x 10^{-6}.'"

Dual Voltage Bench Supply

Angus E. Smiley: "In your October 1990 issue, page 10, 'Dual Voltage Bench Supply,' you never give a part number for Q1, the NPN transistor. I'd like to know what it is."

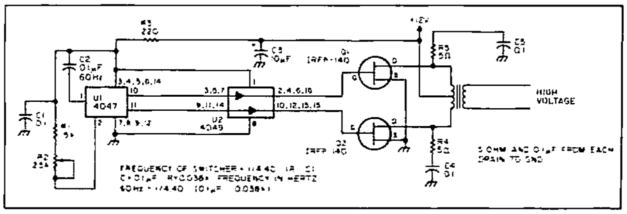
Hugh Wells W6WTU, the author, says you may use a common 2N2222 or 2N3904. Either will work fine.—Eds.

The Switcher-Driver

As promised in WB6IGP's "Above and Beyond" column in this issue: The schematic for his home-brew power supply switcher-driver. The foil pattern and parts placement diagrams are in the August 1990 issue.

Switcher-Driver Parts List

R1	15k	1/4W
R2	25k	pot
R3	220 ohm	1/4W
R4,5,6	5 ohm	1/4W
C1,4,5	0.1 µF	
C2	select 0.1 µF for 60 Hz capacitor; can vary from 0.1–0.12 µF with a resistor value of 38k (25k pot + 15k) pot; allows frequency adjustment.	
Q1	IRFP140 FET100V @32 amps max	
Q2	IRFP140 approx. 200W max	
U1	CMOS 4047 multivibrator	
U2	CMOS 4049 Hex inverter	



Schematic for the power supply switcher-driver in the August 1990 "Above and Beyond."

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Expandable TSDQ..$ 89.95 Optional QUAD...$ 99.95

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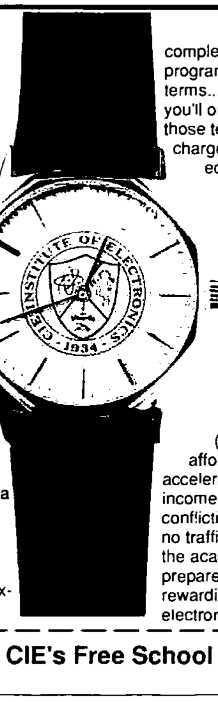

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Amateur Radio Software

With construction and gadgets the major topic of this month's *73*, we'll concentrate on a type of gadget here in "RTTY Loop." To wit, I'd like to present some of the most requested "gadgets": RTTY software.

The following information was obtained mostly from flyers supplied by software vendors or, in some cases, from reviews in *QST*. Please check with the vendors for the latest product details and pricing.

Apple II Amateur Radio Software

List compiled by N6BIS, last updated 1/7/91. (These products are not endorsed by Apple Computer, Inc.)

Packet Radio *APR (Apple Packet Radio)*. For use with TNC-2s. Requires a Super Serial card in the computer. Larry East W1HUE, P.O. Box 51445, Idaho Falls ID 83405-1445. Send a blank 3.5-inch or 5.25-inch Apple II disk and a stamped, self-addressed disk mailer.

PACHAM. Uses a two-microchip interface instead of a TNC. DaJu Development Company, 39 Long Ridge Road, Carlisle MA 01741. Price, $49.95.

Morse Code Practice *Morse+Plus Morse Code Tutor*. EPO Software, 7805 NE 147th Avenue, Vancouver WA 98682. Price, $15.95.

Note: The Sept. 7, 1990, *ARRL Letter* mentioned that the Computer Foundation for Handicapped Children has some Morse code programs for the disabled. Contact them at 2645 East Southern, Tempe AZ 85282 for details.

Morse Code & RTTY Operation *HAM*. Sends and receives both Morse code and RTTY. DaJu Development Company, 39 Long Ridge Road, Carlisle MA 01741. Price, $49.95.

Code Machine. COTEC, 13462 Hammons Ave., Saratoga CA 95070. Price, $29.95 (discount if bought with another COTEC program).

RTTY Machine. COTEC, as above. Price, $29.95 (discount if bought in conjunction with another COTEC program).

Satellite Tracking *Apple QuikTrak*. AMSAT, P.O. Box 27, Washington, DC 20044. Price, $25 for AMSAT members; $35 for non-members.

Antenna Design *Antenna Design & Dimensions*. EPO Software, 7805 NE 147th Avenue, Vancouver WA 98682. Price, $9.95.

Antenna Trap Designing. Larry East W1HUE, 119-7 Buckland St., Plantsville, CT 06479. Send blank formatted disk with stamped, self-addressed return disk mailer.

Logging *Electrolog II*. EPO Software, 7805 NE 147th Avenue, Vancouver WA 98682. Price, $18.95.

Contest Log & Dupe Sheet. EPO Software, as above. Price, $13.95.

Macintosh Amateur Radio Software

List compiled by N6BIS; last updated 11/24/90.

Packet Radio *NET/Mac (KA9Q TCP/IP)*. Supports AX.25 and NET/ROM as well as TCP/IP functions. Requires a TNC with KISS mode. Doug Thom N6OYU, 1405 Graywood Drive, San Jose CA 95129. Send formatted 800K Macintosh disk with stamped, self-addressed return disk mailer. Also available via anonymous FTP from apple.com (/pub/ham-radio) and platypus.uofs.edu (/pub/HAM-RADIO); on the Digikron Systems BBS at (408) 253-1309; the WB3FFV BBS at (301) 625-0817, 625-9482, and 625-9663; and the N8EMR BBS at (614) 895-2553 (or via AMPR.NET FTP at 44.70.0.1). The KA9Q package is copyrighted, but free for noncommercial use.

MacRatt with FAX. Terminal program for use with AEA's PK-232 multimode controller. Supports packet, CW, RTTY, AMTOR, and facsimile. Includes computer-to-TNC cable. Advanced Electronic Applications (AEA), P.O. Box C-2160, Lynnwood WA 98036. Price, $59.95.

Morse Code Practice *N6MZV Morse Trainer*. RT Martin, N6MZV, 10382 Orange Avenue, Cupertino CA 95014. Also available via anonymous FTP from apple.com (/pub/ham-radio). Price, $25.00.

Morse Tutor. Jack Brindle WA4FIB, Brincomm Technology, 3155 Resin Street, Marietta GA 30066. Send formatted 800K Macintosh disk with stamped, self-addressed return disk mailer. The program is copyrighted, but free for noncommercial use.

MacMorse. David A. Kail, 700 Marine Parkway #314, New Port Richey FL 34652. Price, $29.95.

Zihua Morse. Zihua, P.O. Box 51601, Pacific Grove CA 93950. Price $39.95 without speech synthesis; $65 with speech synthesis.

RTTY *MacTTY*. Summit Concepts, Suite 102-190, 1840 41st Ave., Capitola CA 95010. Price, $39.95.

Logging *LOGic*. Personal Database Applications, 2634 Meadow Bend Court, Duluth GA 30136. Price, $75.00.

FDLog! System One Control, 3900 85th Ave N, Suite 200, Brooklyn Park MN 55443. Price, $29.95.

Satellite Tracking *QuikMac*. AMSAT, P.O. Box 27, Washington, DC 20044. Price, $40 for AMSAT members; $50 for non-members. Requires Microsoft BASIC.

Satellite Orbit Prediction Program. Macintosh conversion of W3IWI program. Earl Skelton, N3ES, 6311 29th Place NW, Washington DC 20015. Send formatted 800K Macintosh disk with stamped, self-addressed return disk mailer; or send SASE for source listing. Requires Microsoft BASIC.

MacSat. BEK Developers, 1732 74th Circle NE, St. Petersburg FL 33702. Price, $10.00.

MacSat 3.0. Geodetic Research Services Ltd., P.O. Box 3643, Station B, Fredericton, N.B. E3A 5L7, Canada. Price, $50.00 (add $10.00 for airmail postage and handling).

Satellite Helper. MacTrak Software, P.O. Box 1590, Port Orchard WA 98366. Price, $59.95.

Satellite Pro. MacTrak Software, as above. Price, $99.95.

Propagation, Gray Line, DX Headings *DX Window*. Creates on-screen an azimulhal equidistant projection (great circle) world map centered on your QTH, with day/night terminator. Engineering Systems, Inc., P.O. Box 939, Vienna VA 22183. Price, $39.95.

Skycom 1.1. Enter solar flux and get propagation predictions to desired areas of the world. Engineering Systems, Inc., as above. Price, $39.95 ($59.95 with Skycom 1.5).

Skycom 1.5. Provides sunlight status at both ends of the path; MUF, F0F2, and FOT frequencies; S/N ratio of the link, and other information. Engineering Systems, Inc., as above. Price, $39.95 ($59.95 with Skycom 1.1).

DX Helper. MacTrak Software, P.O. Box 1590, Port Orchard WA 98336. Price, $34.95.

Sun Clock. Desk accessory. Displays a map of the world with day and night areas. MLT Software, P.O. Box 98041, 6325 SW Capitol Highway, Portland OR 97201. Price, $17.00.

Radio Control *ICOM IC-735 Control*. KE6FG Software, 9763 Pali Ave., Tujunga CA 91042. Price, $49.95.

Test Preparation *Ham Stacks*. HyperCard stacks containing all of the questions in the current question pool for each license class. Diana Syriac N1GZS, 49A Meadow Pond Drive, Leominster MA 01453. Send two formatted 800K Macintosh disks with stamped, self-addressed return disk mailer. Also available via anonymous FTP from the pub/ham-radio directories on apple.com and platypus.uofs.edu.

Collections and Miscellany *MacNet*. Public-domain programs (currently on nine disks) contributed by Macintosh packet users. Includes test preparation, contest logging, propagation prediction, satellite tracking, and amateur television. John D. Seney KB1HE, 144 Pepperidge Dr., Manchester NH 03103. Send formatted 800K Macintosh disks with stamped, self-addressed return disk mailer. Contributions of public-domain programs encouraged.

"Project Mac." Contest logging, antenna design, satellite tracking, clip art, etc. Microsoft BASIC required for many (but not all) of the programs.

Stan Horzepa WA1LOU, 75 Kreger Drive, Wolcott CT 06716. Send three formatted 800K Macintosh disks with stamped, self-addressed return disk mailer.

Amateur Radio Software for Macintosh. Extensive catalog including logging, Morse code, Novice, gray-line, satellite tracking, contesting, packet, and CW programs. ZCo Corporation, P.O. Box 3720, Nashua NH 03061.

Amateur Radio #1. Contains satellite tracking, Morse code practice, Ohm's law calculator, and pad design programs. Kinetic Designs, P.O. Box 1646, Orange Park FL 32067. Price, $4.00.

Red Ryder 9.4. Terminal emulation program, suitable for packet radio. Kinetic Designs, P.O. Box 1646, Orange Park FL 32067. Price, $4.00.

MacScience BBS. Various ham-related applications, including antenna design, propagation, WEFAX, packet, and Morse code. Tel. (408) 866-4933.

Digikron Systems BBS. Various ham-related applications, including logging, propagation, Morse code, and packet. Tel. (408) 253-1309.

WB3FFV BBS. Various ham-related software, including packet, contesting, and Morse code applications. Tel. (301) 625-0817, 625-9482, and 625-9663.

N8EMR BBS. Various ham-related files, including packet, Morse code, DXing, and contesting software; AMSAT bulletins; and several ham newsletters. Tel. (614) 895-2553. Also available on AMPR.NET at 44.70.0.1.

Tandy Color Computer Software

List compiled by N1ENA, last updated 1/15/91.

CoCoPACT (for 64K CoCo1 or CoCo2) and CoPACT3 (for CoCo3). Monty W. Haley WJ5W, Rte. 1, Box 210-B, Evening Shade AR 72532-9735. Mike purchased this package about a year ago and it came with free PBBS software. Both programs have split screen operation, 40k QSO buffer, 10 macros, and an editor for off-line use. CoPACT3 (for CoCo3 only) uses 80-column display, additional 24K buffer, and optional 2400 baud serial port data rate. Price, $21.95 postpaid for both programs.

CoCoPacket. Brian Carling, 5131 Raywood Lane, Nashville TN 37211. Mike never tried this program. It's mentioned in the packet software list on page 5-5 of the ARRL's *Your Gateway To Packet Radio* book. Price unknown.

SMARTY2 (for CoCo3). James A. Sanford WB4GCS/NNN0HDF, 20 Glen Forest Drive, Hampton VA 23669. This is a RTTY program for the CoCo3 with an external terminal unit. It has split screen, SELCAL, several Baudot speeds and 300 baud ASCII. Mike bought this one about two years ago. Price, $15.00.

BBS: Thermal Fusion BBS. Greenville SC. (803) 862-7544, 300-9600 baud, 8N1. This is a free Ham/OS9 BBS with CoCo ham radio programs posted on it.

My sincere thanks to Patty Winter N6BIS and Mike Nadeau N1ENA for the information presented this month. No doubt there are more such programs "somewhere out there." And as you, the loyal readership, let me know about them, I'll be sure to share the information with the rest of you! Meanwhile, I've got more goodies on tap for next month, so don't miss that edition of "RTTY Loop"!

Number 24 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton CA 92633

T-Hunting Stolen Cars

Radio direction finding (RDF) began as a way of finding the position of ships during World War I. The first transmitter hunters were sailors. Then the military put it to work locating aircraft and, as a result, RDF played a vital role in World War II. Later, search-and-rescue crews, the FCC, and ham radio operators discovered its usefulness.

Now, RDF has become the latest tool of local law enforcement. Peace officers across the country are learning to T-hunt, and they're excited about it.

In 1978, an entrepreneur named Bill Reagan wondered if RDF technology could reliably locate stolen cars and hijacked eighteen-wheelers. He and Sheldon Apsell, an engineer and radio ham, developed the concept and called it "LoJack ™," to contrast with "hijack."

It took five years to design the equipment, and another two years to prove the feasibility of a wide-area RDF dragnet to authorities in their home state, Massachusetts. Test hunts of 800 simulated stolen vehicles had a 100 percent success rate, averaging 11 minutes homing time. In July 1986, the system became available to the public. Today there are 300 police cars with DF units, and 70,000 vehicle transmitters, in Massachusetts.

LoJack expanded into southeast Florida in 1988, then into New Jersey and southern Michigan. Southern California went on line last summer, and Chicago four months later.

The new Southern California Stolen Vehicle Recovery Network (SVRN) represents a $1.7 million investment for LoJack. The company donated the SVRN computer software and police RDF units. But the investment should pay off well, because the SVRN could take a big bite out of the auto theft industry here.

Over 129,000 vehicles are stolen in Los Angeles County every year, which works out to one every four minutes. Average loss per theft is $6,000. With an extensive ad campaign on television and in new car dealer showrooms, LoJack hopes to install 20,000 transmitters in the first year of business here, and expand the SVRN to other Southern California counties.

Cops Turn On the T

To prevent false alarms, the LoJack unit (LJU) is independent of any other alarms in the car. The transmitter is turned on only by police, and only after the owner reports that the vehicle has been stolen. The whole process is automatic.

When police routinely enter a vehicle into the CLETS state-wide stolen vehicle computer system, the information is transmitted to the special SVRN computer at police headquarters via a 9,600 baud landline link. The SVRN computer checks its data base to see if there is a LoJack match to the stolen vehicle's ID number. If so, Sector Activation Transmitters (SATs) broadcast a coded message to the LJU, causing it to start transmitting once every 15 seconds. The entire activation process takes about a minute.

Seven SAT sites ringing Los Angeles County, with 300 watts ERP at each site, insure that the LJU will be activated, unless the thieves have driven it into an RF screen room. The activation code is sent twice, five minutes apart, then repeated every half hour for good measure.

To save power and to prevent interfering with any DFing in progress, the LJU goes into a low duty transmit mode when the vehicle is first reported stolen. When the car's transmitter is first heard by a police cruiser, the officer radios headquarters, giving the five-character code from the RDF display. The linked computers respond with the vehicle ID and description, so the officer knows what he's DFing.

This inquiry also causes the SATs to broadcast a "query mode" message to the LJU. That increases the transmit rate to once per second, to speed up the homing process. After the vehicle is recovered, the computer tells the SATs to deactivate the LJU, and reset it to be ready for use again if needed.

The police need not know if a stolen car has LoJack when they enter it into the CLETS computer. The SVRN computer does not alert police when it sends out an activation. A LoJack T-hunt doesn't start until the signal shows up on the RDF set (called a PTC) in an officer's vehicle. At that time, the officer knows he is only a few miles away from the hot car.

Hundreds of Hunters

It's hard for a thief to elude the system: 465 police and sheriff cruisers in Los Angeles County have PTCs. That's over 50 percent more than in Massachusetts, even though Los Angeles County is one-third the size of the Bay State. Installations are being planned for police helicopters and boats, too. All but one of the law enforcement agencies in Los Angeles County are participating in the program.

Micrologic Corporation makes the PTCs, which use "pseudo-doppler" technology in the VHF "high band," between 150 and 174 MHz. The electronically-rotating antenna array has four whips, in a square pattern, on the squad car's roof. The display unit (see the photo) resembles the commercial VHF Doppler RDF sets for sale to hams and mariners. It has a 16-LED direction indicator, S-meter, and five-character readout.

The PTC is more sophisticated than a typical Doppler RDF set. It gets a bearing on each transmission burst, holds it, and displays the code of the vehicle on the five-character readout. All activated LJUs transmit on the same frequency. Officers can get bearings on more than one car at a time, distinguishing them by their unique codes on the display. To prevent confusion when closing in, the PTC can be locked to display bearings from only one selected LJU.

The LJU, built by Motorola, is the size of a chalkboard eraser. It is mounted in the vehicle in one of 35 inconspicuous places, randomly selected. Usually the owner has no idea where his LJU is. No warning stickers are put on the vehicle. That's good, because a significant number of vehicles are taken at gunpoint. It would not be good if thieves could force owners to reveal the LJU's location so they could destroy it.

Transmitters put out two watts, and draw only 400 mA when transmitting. If the thief tries to disable the LJU by disconnecting the vehicle battery, an internal sealed lead-acid battery will keep it on the air. Even if that battery runs down, the LJU will remember its mode (activated or not), and come up in that mode when the battery is reconnected.

Results Guaranteed

So, how are Southern California peace officers doing at T-hunting? Very well, thank you. Since the system came up on July 20, 1990, there have been 22 stolen vehicle activations. All cars were recovered within 24 hours. Average time was three-and-a-half hours. The fastest took only 14 minutes from the time the report was filed.

Two recoveries here resulted in busting large theft rings. Arrests were made in a quarter of the Los Angeles cases, which is typical for LoJack pursuits. The national average for non-LoJack car thefts is arrests in only 5 percent of the cases.

Auto theft has gone down 9 percent in Massachusetts, and some insurers there offer lower rates to LoJack-equipped vehicles. About 4.5 percent of all new cars sold in that state get equipped with LJUs.

LoJack was careful to design a system that is as reliable as possible, and stands by it with a two-year warranty. The company will refund the LJU's purchase price if the vehicle is not recovered within 24 hours of being reported stolen.

Police like the system because it enhances their safety. All too often, police officers have been killed or injured in the line of duty when they unwittingly pulled over a stolen car. Officers know that a vehicle with a squawking LoJack unit has been reported stolen, and can take appropriate precautions when approaching it.

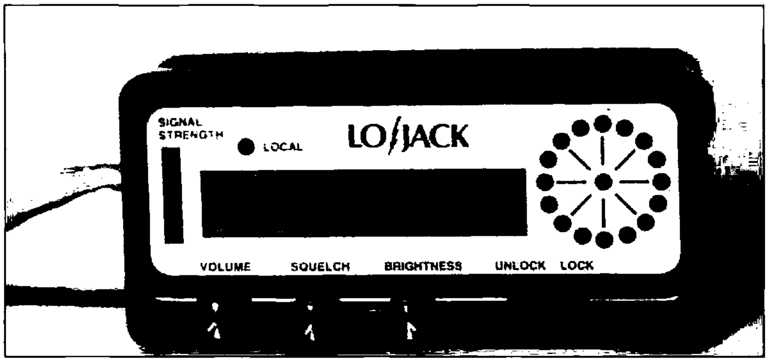
Of course, the LoJack system is not perfect. For one thing, the vehicle must be reported stolen before DFing begins. That's good because it prevents false alarms. But, if the owner doesn't discover the theft promptly and report it, the vehicle could be long gone. That's another disadvantage—the limited range of the dragnet. Doppler technology limits each squad car's tracking range to about five miles. The helicopters will do better, of course.

The company claims that short range isn't a problem, because of the large number of PTC-equipped police cruisers. Furthermore, thieves usually let stolen cars sit in a nearby safe place to "cool off" before driving them out of the state, or out of the country.

Perhaps, but one stolen Jeep in Los Angeles was recovered just two minutes before the 24-hour guarantee ran out. Apparently it had been driven 200 miles out of the area and back again.

Add to this the possibility of a slow-up due to down time at the CLETS statewide computer, and you have a system that is not foolproof. In Massachusetts, the recovery rate has dropped slightly every year, from 97.9 percent in 1987 to 94.4 percent in 1990. Still, that's an impressive record. It speaks well for the robustness of the LoJack system design and the DFing abilities of law enforcement officers.

Too bad the PTCs don't tune to two meters. I could use the help of 465 police cars on some super-tough competitive hunts.



The LoJack dashboard unit includes a 16-LED RDF display, S-meter, and 5-character readout showing the ID code of the vehicle being tracked.

Number 25 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

T/R Controller Relays

The last few months we've done a lot of building in this column! This month we'll tie up several loose ends. The two projects, the T/R controller and the universal transmitter, are both easy to build and get running. Very few components are critical. Your local Radio Shack store can provide most of the parts needed. However, herein lies the first problem.

The onboard relays used by the T/R controller have been discontinued from Radio Shack. However, some stores still have them until the stock runs out. Because the PC board pattern is designed to use this particular relay, nothing else will fit the board. Unless you happen to come across the same relay surplus! Of course, you could use a junk box relay mounted off the board as I have done. Just be sure the coil current is not more than the switching transistor can carry. Down the line, if there is enough interest and a suitable relay is found, the PC board may be re-designed.

Some readers complained that the sidetone will not operate. There is a simple fix for this problem. Be sure the sidetone-in and sidetone-out pins are connected together! If they aren't, the tone oscillator won't work. Speaking of the sidetone, you don't have to build both the sidetone and the relay switching if you don't need one or the other. If you need a sidetone generator and amplifier, just build that part of the circuit. To turn on the sidetone, just apply +12 volts to the sidetone-in pin.

If you plan to operate the complete T/R controller with a transmitter, such as the universal transmitter, make sure you operate both the T/R controller and the transmitter from the same power supply.

As I noted earlier, a large battery bank supplies all my power. All my equipment is operating from this source. There is no problem using the controller this way. However, if you operate the T/R controller from a +12 volt supply, AND the transmitter from a DIFFERENT +12 volt supply, things may not work correctly, or work at all. The fix is simple. Just be sure that all devices are operating from the same +12 volt source.

That should reduce any mistakes and provide you with a working T/R controller in no time. Remember, FAR Circuits (18N640 Field Court, Dundee IL 60118) can provide PC boards for both the T/R controller and the transmitter.

The Universal Transmitter

The universal transmitter contains some gray areas, also. The following hints should help clear things up.

The oscillator will work with just about any crystal. There are no tuned circuits in the oscillator. VXO operation is possible, but I've had some really strange results with the crystals I've been using. On 30 meters, I've gotten about 5 kHz worth of swing. As I discussed in an earlier column, almost all of the frequency shift is bunched up on one end of the VXO capacitor.

> ***"Signal reports ranged from 529 to 599; you CAN'T be QRP!"***

My crystals came from Jan Crystals. They are in the HC-25/U holder and have a 20 pF load capacitance. I ordered a new set of crystals from International Crystal, hoping to get a different VXO swing. I ordered AT cut, fundamental crystal in the HC-6/U holder with a load capacitance of 30 pF. The crystal's frequency is 10.106 MHz. In the VXO, I used a 365 pF variable capacitor. I'm not really sure of the exact value of the capacitor, since it came from the junk box.

With the new crystal in the circuit, VXO swing was still only 6 kHz. I tried to add some inductance, but did not see much improvement. I took the same crystal and installed it in a different home-brew transmitter, using a different oscillator scheme. OHMYGOSH! Did I ever get a surprise. With the crystal in the second VXO, I had a frequency swing of 10 kHz, from 10.102 to 10.112.5 MHz. The VXO should not have moved the crystal's frequency down, but it sure did. In the universal transmitter, the VXO swing is upward in frequency from 10.106 to 10.110 MHz. Leave the 0.01 feedback capacitor in the circuit even if you plan to add a variable capacitor to warp the crystal's frequency. You might want to experiment with different values of feedback capacitors. Then let me know the results of your tests, and I'll put them here in this column.

Construction of inductors L4 and L5 need some clarification. Make the wire leads coming from L4 and L5 a different length so that it will be easier to tell which is which. Coil L4 is in series between the collector of Q3 and the 22 ohm resistor. You can check this out quite easily by making sure the collector of Q3 has +12 volts applied to it when the key line is grounded. If you have no voltage on Q3's collector, you've gotten your wires crossed.

Coil L5 is a bit easier to check. One end of L5 goes to the junction of Q4 and the 47 ohm resistor. The other end of L5 goes to ground. With an ohmmeter you should see zero ohms from this point to ground. If you see 47 ohms, you're reading the 47 ohms from the resistor to ground, and coil L5 is then incorrectly wired.

30 and 40 Meters

I was working on a version of the transmitter one night for 30 meters. I didn't have all the correct capacitors, though, so I changed the output filter to suit what I did have.

Use these values for 30 meters. L1 and L2: 12 turns #22 on a T-50-2 core. Jumper the pads used by L3. Instead of the 330 pF cap, use 270 pF. Instead of the 680 pF, use a 560 pF capacitor. Omit the second 680 pF capacitor. Install the second 270 pF capacitor on the antenna side of the filter. You end up with two cores and three capacitors.

For 40 meters you can use the following: L1 and L2; 14 turns #22 on T-50-2 core. Replace the first 300 pF with 470 pF. Jumper the pads used by L3. Delete the second 680 pF capacitor. Replace the first 680 pF with 1000 pF (0.001) and the last 300 pF capacitor with 470 pF. Use silver-mica capacitors in both filters for best results.

Since I don't have crystals for 14 MHz, I did not work out the filter values needed for that band.

If Radio Shack is out of stock of the 100 μH RF chokes, wind your own. Use ten 10 turns of #28 on FT-50-43 core.

The final might be hard to locate. I still have a good supply of hamfest PAs lying about, and that is what I used. If you can't find the part listed, try one of these: RCA 4013, 2N3553, and 2SC2075. Also try the more readily available 2N3053 and 2N3866. Just be careful, as the 2N3866 might become unstable if the leads are too long. Keep the leads short, ⅛ inch from the board, and you should have no trouble.

That should clear up any loose ends on the transmitter. I've worked all up and down the East Coast on 30 meters using this little rig. The West Coast and DX are easy prey late into the night on 30 meters. Signal reports ranged from 529 to 599; you CAN'T be QRP! I know you'll find a spot for this project in your shack.

Since the U.S. postal rates have just gone up, letters without an SASE will go unanswered. Sorry about that, but the postage really cuts into my Diet Coke fund. If you don't want to communicate via the mail, try one of these. Via Compuserve, ID# 73357,222. America OnLine, Michael1087. Delphi, QRPER. I forget what my ID number of Prodigy is, but I'm on that service also. You can also reach me via packet: WB8VGE @ KA8Z BBS. Whoa! It's 1991. One can't live by CW alone! 73

AMATEUR TELEVISION

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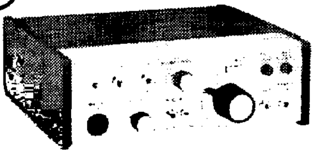

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Letters, Letters . . .

Lots of letters have been coming in, so perhaps now is the time to respond to some of them, and to cover a few interesting topics along the way.

Mick W6FGE asks whether there's any point to expensive, wide-audio bandwidth mikes since the radio cuts everything above about 2.4 kHz off anyway. Well, Mick, it's a good point. A mike with response out to 20 kHz is certainly wasted in amateur communications work. What makes some of the more costly mikes worth their prices is their response *within* the transmitted bandwidth. You'd be surprised how much variation there is between different mikes. The best ones for SSB are dynamics or ceramics, which have a rising frequency curve that adds "punch" to the voice, and helps you to get heard through the inevitable QRM. But the shape of that curve, and the frequency at which it peaks, can really affect the sound. Conversely, the best mikes for FM tend to be condenser mikes, which have a fairly flat response. The cost of a mike is not directly related to its sound. In fact, I've heard some really cheap mikes which sounded great, and some expensive ones which were only so-so. But, some higher-priced units are distinctly crisp and great on the air. The obvious way to find out is to try them. A cheaper alternative is to ask stations you QSO with what kind of mikes they are using. Don't just ask the good-sounding ones—find out which bad ones are out there, too. As for headsets, I have found that common "walkperson" units have far better fidelity than is necessary. They do fine for radio work, unless you need to shut external noise out, in which case you need the around-the-ear kind. As you point out, expensive hi-fi headsets are a waste.

On the subject of audio fidelity, Peter W1UO responds to my "Why Rigs Sound The Way They Do" column and relates his experiences with "hi-fi" SSB. He says that he once worked for the Voice of America, and they used HF SSB for their overseas feeds. Several fidelity-enhancing techniques were used, including diversity reception, phase-locked exalted carrier detection and wideband (6 kHz) SSB filters, each about the size of a loaf of bread! (Wow—imagine the size of a '940 with filters like that!) He says that overseas signals sounded like local FM broadcasts! See, folks, I told you so!

Guillaume K0OKP asks whether AM is permitted on the 220 MHz band. Let me check my ARRL handbook . . . Yup, it sure is. Unless they've changed that since 1985 (OK, OK, I need a new handbook), and I haven't heard of any such change. I doubt, though, that you'll find too many people to talk to up there on that mode. FM is the popular mode these days, with SSB and CW used for weak-signal work. But hey, give it a try, you never know.

A 17-year-old ham named Sean (no call on the letter) says that someone stole his TS-430S (*shame* on them!) and he can't afford another one. He has a digital shortwave receiver and wants to know if he can use its local oscillator to drive a preamp and power amp to make a simple transmitter. Sean, I'm afraid it just isn't that simple. In a superheterodyne receiver, which virtually all modern sets have, the local oscillator does not run at the frequency you are receiving! There is a rather large frequency offset, and that offset depends upon the first IF frequency. For instance, if the first IF is at 10.7 MHz, the local oscillator will be either 10.7 MHz higher or lower (depending upon the receiver design) than the frequency to which you are tuned. The only ways I can think of to get the frequency you want would be to design a mixer and inject another local signal to shift the frequency, or to reprogram the frequency on transmit so that it is in the right place. Either would be a great deal more trouble than it is worth. And there are other problems, such as stability, purity and signal level. All in all, consumer shortwaves just don't have what it takes to make decent ham rigs. A far better alternative would be to buy a cheap older transceiver at a hamfest and use your time and ingenuity to fix it up. In the end, you will be much happier with the results. And, you won't risk ruining your shortwave in the process.

Kenneth KA8RUA describes his frustration at trying to get schematics and service data for telephone gear such as cordless phones and answering machines. He asks whether it is legal for the manufacturers to withhold such information. Well, as far as I know, there is no law requiring them to give their data out. And I, too, have run into this brick wall regarding a broken answering machine. I suppose there could be some law prohibiting the general public from tampering with equipment connected to the phone lines, but I don't think so. I know of at least one major manufacturer that sells service manuals for their telephone gear. So perhaps the others are just being pigheaded and greedy, hoping you'll buy another unit or send yours in for an expensive repair job. I agree, it stinks. Let's be glad the ham manufacturers have more sense than that!

Dean KF7CR asks several questions, including some already covered in previous columns. But let me give them a whirl. Dean, PLL works by generating a stable digital pulse at a required frequency and then voltage-controlling an analog sine-wave oscillator until it matches the digital reference. The result is a programmable, crystal-accurate local oscillator. Because it's a two-way process (controlling the oscillator and then comparing its output frequency), it is by definition a loop. Hence the name, "phase-locked loop." And yes, your pocket digital shortwave works that way. For a more detailed explanation, please see my column in the March 1990 issue of *73*.

Packet radio is, as you guessed, a form of BBS over the air. It is also many other things, including a nifty auto-forwarding system which lets you place a message on your local BBS and have it delivered in a day or two at a very distant BBS, with no transmission errors. It is called "packet" because the data is transmitted in groups of characters, or packets, with each packet automatically including the originating callsign (yours), the destination BBS and callsign, and error-detecting codes. During packet reception, any detected errors cause the packet to be resent until it is received intact. There's lots more to it, but that's the basic idea. Packet is very useful and fun, especially if you have ham friends in other states or countries, because you can keep in touch without having to be on the air at the same time they are! Get a TNC and try it out! If you already have a 2 meter rig, even a walkie, it is fairly inexpensive and definitely worth it.

As for your noise suppression problems, I think some of them may be very difficult. Dimmers and fluorescent lights generate fast-rising pulses which are just plain stubborn. You are probably best off replacing them with regular switches and incandescent bulbs. As for your VW Rabbit ignition noise, wow—that is the worst I've ever heard of. Since the car eats ignition cables in 5,000 miles, I suspect you have a real problem. Perhaps the ignition resistor relay is stuck. That would allow full starting current to flow even after the engine is running. I had a car with this problem once, and it ate points as fast as yours eats wires. Your high voltage must be *way* too high.

Also on the subject of interference problems, **Winston KB6DHB** asks for help because his rig gets into his TV and stereo speakers, and even a low-pass filter hasn't helped. From what you describe, Winston, it sounds like plain old overload. Too much RF is getting into the TV and stereo. A low-pass filter only helps if the problem is harmonic output from the transmitter, and does no good at all for simple overload. Check to see if the TV gets interference on all channels from 2 to 6. That's a good clue. If it's only channel 2, it could be harmonics. Even with the low-pass filter, some small amount of harmonic energy could be escaping. Also, your G5RV antenna is inherently unbalanced, because one leg is longer than the other. Try a balun at the antenna, or go to a standard dipole. Perhaps that will help keep RF from crawling back up the coax shield. You could also try a line filter, but try disconnecting the TV antenna or cable feed first. If the problem goes away, the interference is getting in from the antenna input, and a line filter will do no good.

Finally, a prospective ham named Robert asks how we get meters from hertz, as in the 20 meter band being on 14 MHz, etc. Well, first let me state that the meter band designations are only approximate, and can never be exact because they are describing more than one specific frequency. But it works like this: For any given frequency, a wave will have traveled a definable distance before its next peak occurs. Thus, the resulting wavelength will get shorter as the frequency goes up, because the wave doesn't have as much time to travel before the next one comes along. The wavelength can be calculated and expressed in meters, feet, or anything you like. A simple conversion from time units (MHz) to distance (meters) will do the trick. The formula is: wavelength in meters = 300/frequency in MHz. The 300 is called a "conversion factor," and is required to relate seconds and meters. As for your other questions regarding the best choice of equipment and proper operating procedure, go visit your local ham club and you will get more advice than you probably want! (We hams *love* to talk about that stuff.) Also, there are some good books available from the ARRL and other organizations. And, of course, don't miss the great product reviews in *73*!

Well, folks, that's about it for this month. Keep them cards and letters coming. But please, save your stamps and return envelopes. It is very rare that I can send individual replies—there's just too much to do. Thanks for your understanding. 73

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Never Say Die

Continued from page 4

palace. I've sat in Geneva representing the U.S. at a world conference. I've addressed the FCC commissioners in hearings. I've helped a youngster in Burma find a wife in Singapore and settle In the U.S. I've visited Father Moran in Nepal. I've helped a ham I met in Yugoslavia move to the U.S. Ditto a French ham. No, I'm not bragging, I'm telling you what *you* can do. I'm telling you what the youngsters you mentor can do.

You're a haml Through amateur radio you can learn about FM, sideband, spread spectrum, computers, digital audio, digital communications, television, slow-scan, RTTY, satellite communications, antennas, feedlines, gates, memory chips, synthesizers, telephone switches, facsimile, radar, LORAN, underwater sound, moonbounce, meteor scatter, aurora communications, and what people are like in around 400 countries.

Whenever I see a picture of the big dish at Arecibo I remember climbing up into it with Sam W1FZJ. And I remember being part of the team that used this 1,000-foot dish to make 1200 MHz ham contacts all over the world.

The real key to what we are going to do when we grow up lies In learning. If we use our time well, we'll be ready for whatever opportunities the world presents. Like Alfie, the world presents opportunities and they are lost due to our blindness to them. I'd already been exposed to technology through my grandfather, who was an inventor, so I was able to confidently tackle learning about radio.

Are you daunted by packet? By satellite communications? Perhaps, no matter your age, it's time to be adventurous and become an expert In a new aspect of the hobby. We need pioneers, even if they need walkers to get around. Even if you're 80, you still have a lot of growing to do. It's not too late to plan what you're going to do when you grow up.

And once you have some perspective on life, maybe you can share what you've learned with some youngsters. Teenagers need mentors. Their parents seldom have enough dispassionate perspective to help. So that leaves you. And if you do mentor some youngsters, are you going to be passing along your beliefs and prejudices, or can you give them some straight dope which will really help them cope with their lives?

You remember what teachers were like, so you know how little help they can be. You may even remember about parents. And you're seeing the values today's television provides. Some guidance! If you believe TV, all techies are nerds and geeks. Great role models.

In addition to giving talks on entrepreneuring at colleges I also enjoy talking with 5th graders and helping them see some hints as to the possibilities they've got. And I'm mentoring some college students, too. I only wish there was a medium where it would be

QSL of the Month To enter your QSL, mail it in an envelope lo *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL ot the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not In envelopes cannot be accepted.

possible to reach kids with some unbiased information on how the world works and how they can not just cope with it, but also help improve it during their tenure.

As for me, I've never had any illusions about my growing up. It's never been a goal. Now I find that's par for creative people, so I guess I don't feel as defensive as I did when I was a kid about making the world conform to me instead of my conforming to it. World, shape up, and get a move on, I haven't got all day!

Are you doing your homework? Are you reading magazines and books, talking with people, building things? Where were you in 1975 when microcomputers came along? Where were you when I was preaching computers? I was 53 then. Did I face this whole new technology and give up? No way! Within a year I was giving lectures on computers to computer professionals. Sure, I did a lot of homework. I still meet people who took my advice at the time and got into computers. Some became fabulously rich. Some didn't. But everyone enjoyed what they were doing.

We have similar opportunities today with direct satellite broadcasting, high definition TV, digital audio, digital TV, digital signal processing, personal telephones, data compacting. . . it's an endless and exciting world ahead in technology. And amateur radio is the key to this world for youngsters.

Are you learning and teaching? Are you mentoring? Or are you grousing about no-code, how bad things are on our bands, and being in general a useless negative curmudgeon? Sure, I see the problems, but I love problems because they call for creative solutions. The fact that you are allowing a few idiots to screw up 14.313 every day and do nothing more than wring your hands about it is pathetic.

Sure, it takes confidence to see a need and actually do something about it. That's what got me into publishing in the first place. I didn't know anything about it, but I knew I'd learn. And, as I mentioned recently, I'm still learning. I still go to publishing conferences and attend seminars. Much of the time I should be teaching 'em, but I know I've plenty more to learn.

That's what keeps me reading piles of magazines and a couple books a week, year after year. One whole end of my home is sagging under the weight of my library.

I love to learn about music, loo, so somehow I manage to listen to a half dozen or so CDs a day. The music industry is fascinating and I'm having a ball with it. There are tremendous business opportunities in this field, too. Music and technology have merged, which is great for me.

And if radio and audio don't get you excited, how about becoming an electromagnetic expert and helping find out more about how EM fields affect living cells? You can get a download of references on the *73* BBS and see what I've read so far.

Are you ready to give a talk on the maglev? On NMR? Are you game to help some school classes learn about electronics and communications, if I can get our schools to set up these courses? Or are you spending your declining years pontificating on 75m? Or adding to the pile-ups on 20m?

Ooops, my soapbox is beginning to come apart.

When I Grow Up. . . Part II

Amateur radio may be a great key to learning about technology, but how many of us leave the key in the drawer and don't use it? I'd like not only to get you to take that key out and start opening doors for yourself, but to give copies to youngsters so they can open doors and open up their lives. I know what an impact it's had on my life—how about you? Any chance of your writing to me about it?

The opening doors are entries to learning possibilities. How can we learn? How do we educate ourselves to take advantage of amateur radio's potentials?

In retrospect, I think I learned less during my years in college than I have in almost any year since then. My college wasn't set up to really teach. It was geared to students memorizing data in order to pass tests. I found it profoundly frustrating. This was why I've gone back to my college to try and help them become more productive and relevant. That's a whole story in itself, but I'm making progress—and so is my college.

I was out of college two years before I discovered self-teaching through reading. Since then I've built quite a library. I've probably averaged a book or two a week for the last 40 years, plus at least 25 magazines a week.

It's exciting to learn. Suddenly grasping a new concept brings a rush . . . a thrill. For instance, my recent adventures in digital audio have been fantastic—it's a whole new technology. Do you understand 1-bit technology? Why not? If you have the time to watch a basketball game, you have the time it takes to understand 1-bit technology. The ball game Is soon over and forgotten. The understanding of a new concept will be with you for life. And yes, of course it can be important to amateur radio.

If we're able to keep some of our ham bands through the next couple WARCs, we're going to eventually go digital, complete with data compacting systems we haven't even thought of yet. Have you read much about data compacting technology yet? How about fractal math and chaos theory and their applications to communications?

For instance, you CW fans who are used to bleeping away at each other at a snail's pace, has it ever occurred to you to strive for more throughput? One creative approach might be to take the "Q" code concept to the next level of abstraction. A study of amateur communications will, I suspect, show that it'd be simple to develop a ham oriented "Pidgin English." We could encode the few dozen basic communications concepts we have settled into using into a simple code. Instead of sending "QSL?" we could substitute one 8-bit character for the four we've been using. Eight bits gives us 256 different combinations, so with just one character we could convey 256 different ideas. That's more than we use in a week of average ham contacts and it increases our throughput four times. This, in turn, will allow us to use only 25% as much bandwith, allowing four times as many QSOs in a band.

If you feel that's too limited then, heck, let's blow it right out to 16 bits and have 65,536 concepts. That's more concepts than I've heard discussed over the air in 20 years. But it would be a simple way to cover a wide range of ideas in a hurry and get beyond the "please QSL" contact limitations.

Several readers have written, asking how they can uncover mutual Interests during contacts. Using our present system it ain't easy. How would I be able to find out if the chap I'm talking with is into skin diving? Photography? Cooking? Miatas? Gaia? Cosmology? UFOs? Macintoshes? South African folk music? Roller coasters? Or that he's been to Bali, Cairns, Xian, or Kota

Kinabalu? A bit of encoding could compress each of thousands of interests into one single 16-bit datum.

Upon making contact, the other chap could send his name and location, followed by a string of interest codes. It doesn't take much computer power to tell me which fits in with my interests. And off we go.

Of course if you really insist on making this compatible with smoke signal technology, we could stick to our typewriter characters and send them via Morse's code. With 26 letters and 10 numbers we have 36 characters at hand. Three characters would give us 46,656 combinations. Will that hold you? We could even call it a "Q-code" if we initiated the code groups with a "QQQ" starting sequence. I doubt that we'll be wasting spectrum space with Morse code for much longer—unless of course we keep our present bands and we are unable to generate any more growth than we have in the last 25 years, in which case we can continue happily with our antique communications modes for years.

Many years ago I suggested we build a 65,000-word dictionary and assign a number to each word. Then all we'd have to do is send a string of numbers and our computers would translate them into words again for us. This would increase our throughput by three times and allow us to narrow our bandwidths by that.

A couple of added advantages would be that this would, for the first time, allow foreign amateurs to talk with us via computer-translated messages. Also, if we want security all we have to do is scramble those 16 bits around in a predetermined way. At a 9,600 baud rate we could have a throughput of around 25,000 words per minute. A 400-word message would zip through in one second.

Let's say that I've piqued your imagination and you've decided that you are willing to take the initiative and learn about some new phase of amateur radio. How are you going to go about it? Well, if you have a solid set of *73* and *QST* back issues, you've got a good start. Then you'll want to look for specialized ham newsletters to take you to the next phase.

That's what got me into this whole publishing mess in the first place. I was enjoying RTTY pioneering and got fed up with the lack of information, so I started a newsletter in 1951. It's obviously gotten way out of hand.

Alas, only a few of the hams involved with developing new technologies have enough interest in helping others to bother writing, so information is not easy to find. In the early days of repeaters there were some marvelously well-developed repeater networks such as the Gronk Network, which provided instant communications from San Diego to San Francisco and all the way out to Phoenix. I pled with them to encourage other similar nets to be developed around the country by writing. Too much trouble. I tried everything I could to get them to write. Part of the problem was laziness, part a smug protection of what those involved had learned. An unwillingness to share with others.

If you'd like to help, there are some easy ways to do it. For instance, there are tons of electronics and communications books in print. Unfortunately, many are poorly written and are not nearly as helpful as they might be. So, when you find a book you think will help others learn about some aspect of electronics or communications, how about taking a few minutes to review it? If you can let me know what you've found, I can pass this along and everyone will benefit—and we may even add it to Uncle Wayne's Bookshelf.

By focusing attention on the better books, we'll help discourage publishers from flooding us with drek. And by helping the better authors to be rewarded we'll end up with more good books. Make sense?

One of the reasons I knew *Byte* was needed was that when I read the available computer books I discovered they were almost impossible to understand. Instead of putting this down to me being dumb, I decided it wasn't me and that the microcomputer, which had just been invented, would bring about an enormous demand for easy-to-understand information. So I started magazines to fill this need. Wow, was I right on that one!

I read a book or two a week. A few of them I would love to recommend. If you're interested I'll try to keep you abreast of my reading. This would be better via our *73* BBS than in the magazine since only a small percentage of my reading is ham oriented and I suspect that most *73* readers are interested only in amateur radio oriented books and could easily turn nasty if i suggest reading anything beyond this narrow field.

But let's just suppose that you are 20, 40 or even 60 and reading this. At 20 you're just getting started in life. You're probably about to graduate from college after 16 years of third-rate education. You are undoubtedly one of the more fortunate graduates in that you are able to read and you have an interest (hamming) which you can parlay into a career. Of course you're going to have to make a big decision. You're going to have to say, "Enough with all this school nonsense, I've got to start really learning."

Of course if you get sucked into wasting your life on non-career sidetracks such as politics, religion, and righting an almost infinite number of the world's wrongs; or you let peer pressure get you involved with drugs such as alcohol, cigarettes, and worse; or you get involved with watching sports events, others are going to quickly pass you by and you're going to have to be satisfied with being jealous of those with successful careers and angry at yourself for screwing up.

At 20 you can pick any branch of electronics and within a year become an expert. Or you can coast through life waiting for a lucky break or a state megabucks win. But since you're not going to be tuned into passing opportunities, you're going to miss most of 'em.

At 40 you're having to face up to how dumb you were at 20 not to invest your time more productively. This is when men make mid-life changes. It's your last big chance to get on a personal career path which leads somewhere. It's your last chance to shape up and get the education you were too busy to bother getting at 20. Well, I'm sure those hundreds of ball games you've watched will comfort you in your old age. . . which is now looming immediately ahead of you. Forty *is* middle age. After 40 it gets increasingly difficult to find work. And it's difficult to down-size your lifestyle if the axe falls and middle management at your company is suddenly cleaned out.

At 60 you're very unlikely to ever get another job. You're on your own now. Have you stored up enough money to coast the rest of the way, golf clubs in hand? Have you enough on the ball to make a living as a consultant?

At 60 you've got a good chance at 20 more years (unless you smoke), so there's still time to start from scratch and become an electronics expert in some field. I started over when I was 61. Well, yes, I had a little money put aside to scratch with. At 61 I picked an entirely new field and began to build a new publishing career in the digital audio and music fields.

In my early years I didn't really plan. I took what came, moving from radio to TV broadcasting, then to speaker manufacturing, with side trips into psychology and music. I think my first major career decision was when I was 38 and started *73*. I knew that was a long-term decision.

My second decision was, as I said, at 61. Both turned out to be good decisions. Today I have plans going out for the next 20 to 30 years—probably far beyond my life expectancy. I'm glad I learned to learn when I was 28—and regret the years I wasted before that.

It's no news flash that education is the key to success in any way you want to measure it. I'm not talking schools, because you can educate yourself far better and faster than any school I've seen or heard of. And you can have more fun doing this than watching football or hanging out at the mall. And that's at any age from around 10 until you finally get that coveted Silent Key award plaque.

If you haven't gotten into packet yet, that's both an easy and fun way to start expanding your technological horizons. Keep notes of your progress and let me know how it goes.

License Growth

The FCC numbers are in for 1990, and if you don't mind ignoring that the FCC doesn't take into consideration dropouts and silent keys any more (since 1984), we've had some growth. If you factor in lost souls and the Grim Reaper, it doesn't look all that wonderful.

If we don't count our losses and we compare the 1990 count against 1987, we find that in four years the number of Generals has grown a mighty 4.7%. Yep, in four years and not counting losses! It's no better for Advanced, which on paper has grown by 4.2%. Wow!

Well, how about Novices? No great number of deaths there, though we can expect heavy dropouts. On paper, in four years our Novice ranks have increased by 13.1%.

Correcting the presently completely spurious FCC numbers depends on how fast we're dying off. If the average ham age today is around 55, then on the average we've got maybe 25 years left before we get our coveted Silent Key award from the League. Let's see, 25 into the FCC total of 500,000 would give us a departing rate of around 20,000 a year. No wonder those lists in *QST* are so long these days! If that's true, and not even counting dropouts, we've barely broken even in the last four years.

Settling the Arab-Palestinian Problem

Oh, good Lord! Now Wayne's going to try and settle the unsettleable. Obviously there is no simple solution to the Arab-Israeli mess. Or to the problems in Beirut, Libya, Iraq and so on. Perhaps it isn't as difficult to come up with a long-lasting peaceful solution as everyone seems to think.

So what's this got to do with amateur radio? It actually does have a good deal to do with it, though I wouldn't let that stop me from writing about it, even if it didn't.

When I first visited Jordan in 1970, I'd already been writing about the critical importance of technology to the progress of a country in my *73* editorials for several years. Amateur radio, I felt, was one of the simplest ways of introducing technology to the public. Through a hobby such as amateur radio, where learning technology is made fun, I believed that youngsters could be encouraged to become technicians, engineers and scientists. One of the main goals of my 24-country, around-the-world DXpedition trip in 1966 was to see if I could get the ITU to embrace amateur radio as a means for developing an interest by youngsters in technology in third world countries.

My first step was to visit the recent ITU ex-Secretary-General in Addis Ababa and ask his advice on how to get the ITU to encourage the growth of amateur radio in third world countries. He loved the idea and said he would make arrangements for me to meet the new Secretary-General on my visit to New Delhi.

He was as good as his word, so when I got to New Delhi I had no trouble in meeting with the new ITU Secretary-General. He too liked my plan for getting amateur radio going in third world countries as a way to introduce youngsters to the hobby. . . and to technology as a result. I promised to provide a set of amateur radio rules and regulations for the ITU to recommend.

I had a wonderful time DXing from Beirut, Damascus, Tehran, Kabul, New Delhi, Katmandu, Singapore,

Noumea, Suva, Apia, Pago Pago, Papeete and on around the world. When I got back I got to work on writing ham rules for third world countries. About this time the Secretary-General had a heart attack and died.

With amateur radio in the middle of the "Incentive Licensing" disaster, I was unable to leave my magazine and meet the new ITU Secretary-General. How bad was the hobby hit? 85% of the ham dealers had just gone out of business. 90% of the manufacturers had, too. My business manager stole all the money he could while I was on my trip and tried to put the magazine out of business so he could start his own magazine. It was a difficult time for me.

By 1970 I was finally able to get away from the magazine for a couple weeks, so when I heard that King Hussein was interested in amateur radio I saw an opportunity to give my third world country concept a try. I sent him a cable offering to help him with his new ham station. He said sure, come on over.

I spent two weeks operating JY1 from the royal palace and talking with His Majesty. I explained the benefits of amateur radio to Jordan. i pointed out that if he set up ham stations in his schools and encouraged Jordanian youngsters to learn about amateur radio, that in short order he'd have a bunch of enthusiastic electronic experts, technicians and scientists.

He gathered his government around a large table so I could explain the idea to them. I pointed out that if Jordan was going to fit into the modern world, it had to have technicians and engineers, and the best way to get them was to interest youngsters in a technical hobby such as amateur radio so they'd learn under their own steam.

When I got back home I updated my ITU amateur radio rules and regulations proposal, printed a few hundred copies on my offset press, and sent them to His Majesty. They used them pretty much as I proposed them.

Soon after I left Jordan a civil war broke out between the PLO and the Jordanians. Even though the country was in the middle of a civil war the school club stations were established and radio clubs formed.

In 1973, when I'd just finished a slow-scan QSO with a chap in Athens, a voice broke in on frequency, "W2NSD. this is Juliet Yankee One." It was His Majesty and he wanted to meet me in Washington in a few days. I met him at Blair House and was handed round-trip tickets to Amman. "I want you to see what you've done for us," he said.

When I arrived in Amman I was met by Hisham Ansari JY4HA, who proceeded to drive me from one end of Jordan to the other, introducing me to over 500 newly licensed Jordanian youngsters. They had set up one or two radio club stations in every city in Jordan.

Hisham had been appointed by the king to travel around the country to help the youngsters learn radio and electronic theory. His enthusiasm and teaching style had helped make learning fun for the youngsters.

They threw lavish parties for me and I got to meet all the top people in the government. I was a hero, at least for a few minutes. That was nice, but the real kick was that my idea had been proven. Now what could I do to get other countries to accept the idea?

Little did I know that two of the worst traumas of my life lay immediately ahead. I've shared those at length in my old editorials, so I'll save their retelling for my memoirs. By 1975 I was deep into computers, so it wasn't until 1983 that I had another opportunity to visit Jordan.

During that short visit, Prince Raad JY2RZ organized a special meeting of the Royal Jordanian Amateur Radio Society and introduced me as having had more of an influence on Jordan than anyone other than the king himself.

Okay, now let's dig into history so I can put the next step into perspective. Those of you who have any familiarity with history know that the Arabs were the world leaders a thousand years ago in philosophy, medicine, astronomy and technology.

"The solution to the Arab-Israeli problem, to the fighting in Beirut and to Syria's belligerence and all the other Arab infighting, lies in education."

The Arabs know this and it is galling for them to have been left behind by the industrial revolution and then, as a result, be exploited by the Europeans. It was technology that enabled the Jews to found Israel in 1948. They'd set up amateur radio stations all through Palestine while it was under British control. Then, when the British pulled out, these ham stations instantly became a military communications system that enabled the Jews to quickly rout the Palestinians. Indeed, amateur radio has been given a great deal of credit for the founding of the Jewish state.

The key to solving the Palestinian problem doesn't lie in distributing territory. That isn't going to solve the basic enmities which will continually erupt in confrontations. That isn't going to ease the frustrations that have built up for the last 43 years and that were exacerbated by the 1967 six-day war and the 1973 war with Egypt.

How About Japan?

Japan tried using their army and navy to gain power. We beat them with technology. Yes, we fought hard, but it was technology that won that war, not just fighting. I was right there up front in a submarine sinking Japanese ships (we sank 27 of 'em), so I know what an enormous difference technology made.

We were able to go unobserved right through the middle of Japanese convoys at night on the surface. I knew where every ship in the convoy was and every move they made, while they didn't have a clue we were there until our torpedoes started exploding all over the place.

After the war the Japanese figured out how critically important technology was and they went after it with a vengeance. Today they're far ahead of us (and the rest of the world) in many high-tech fields. Technology has made Japan #1 in the world in finance. It's enabled them to beat us (and Europe) in one industry after another.

Look at the difference technology has made in warfare. Iraq was outfitted with the latest in technology from France, Germany and the USSR, yet our weapons quickly knocked 'em for a loop. We were one generation ahead in technology and that made all the difference.

What Next, Then?

The solution to the Arab-Israeli problem, to the fighting in Beirut and to Syria's belligerence and all the other Arab infighting, lies in education. With education the Arabs will be able to come up to speed in technology and regain their racial pride.

One of the dumbest moves the blacks made in South Africa was that when they got mad at the whites, they pulled their children out of school. They stopped their education. Talk about shooting themselves in the foot! That just made a lousy situation all the worse, leaving an educational vacuum which could take generations to repair.

Now, back to Jordan. My suggestion is to start with educational programming on the Jordanian TV stations. These programs should be made so interesting that people will watch them because they're entertaining, not because they're educational.

In addition to everything normally taught in grammar school, I'd also include a course in the fundamentals of electronics, computers and communications. I'd encourage the youngsters to start electronic experimenter clubs, radio clubs, computer clubs, science fair clubs and so on. I'd encourage the youngsters to get together to help each other learn more about all kinds of scientific things.

If Jordan is going to cover everything, it'll take several TV stations, and the people will need VCRs to tape courses broadcast at inconvenient hours. Once broadcast, the tapes can be made available for home rental.

There is nothing at all the matter with Arab intelligence. They just need education and they'll give the rest of the world a good run for their money. The method I've described would provide this education at the lowest possible cost. It also wouldn't be held up for 10 to 20 years while new teachers are trained.

A few Arab countries have oil, but most have little more than their people as a resource. Educated, they can be the most valuable resource in the world. Uneducated, they are likely to be frustrated and thus easily gulled by fanatics. When we see screaming Arab mobs, we know we are not looking at educated people.

Japan has shown how it's done. We're learning many things from them. Perhaps the Arabs can too. Japan has well over a million licensed amateurs so far. The Arab countries, what, dozens? Outside of Jordan, I doubt it.

If they start teaching science to Arab youngsters we may start seeing hundreds of thousands appearing on our bands. Then, if we've decided to use amateur radio to actually talk with people instead of coercing QSL cards out of them for DXCC credit, we may finally have people-to-people communications and start building friendships.

Yes, I make it sound simple. I think it is. I'd like to see His Majesty King Hussein start providing education for his people and the nearby Palestinians in Israel. Then, via educational video tapes, Jordan can become the education center for the entire Arab world.

Science teaching will go much faster if the video courses are supported with good textbooks and science labs. I've some inexpensive, creative solutions to these needs too.

No, you can't force people to be educated. We've certainly proven that here in the U.S, where our compulsory system is a world class failure. But you can make it so much fun that kids learn because they enjoy it. And the more they learn, the more successful they'll be as a people and the wealthier their countries will become. And this can be done in one generation.

We've seen this in microcosm in amateur radio. No one forced us as kids to learn radio theory. We did it because we wanted to, because we enjoyed it. And the more we learn, the more potential we have for success in today's technological world. We are no longer tolerant of computer-illiterate people in our workplaces.

If we can get the Arabs hooked on education, who knows. . . perhaps we'll even be able to sell this radical idea here in the U.S.!

Am I suggesting that it's possible to turn nomadic goatherds into rocket scientists in one generation? Yep, that's exactly what I'm suggesting.

Since this is an editorial, not a book, I haven't gone into depth with my entire plan. I thought I'd mention that just to ward off the brickbats from negative people. Let me remind you that successful creative thinkers are positive. They tend to think in terms of solutions rather than problems. Is that the way *you* think? 73

Number 27 on your Feedback card

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

YIG Sweeper

Last month I described the YIG (Yttrium Iron Garnet) oscillator and its internal construction. I also covered a sweep ramp generator, part of the YIG sweep oscillator project. This month, I'll finish the project with the drive circuits for the YIG oscillators. The sweep ramp generators tie directly into the driver circuits, providing both the YIG current control amplifiers and the oscilloscope with an external, horizontal drive, for full synchronization of both the YIG oscillator and oscilloscope.

The sweep ramp generator has controls for ramp symmetry and sweep length. The 1458 op amp operates from a +15 and −15 volt power supply. This is necessary because of the need for a wide swing between both power supply rails. Sweep ramp voltages for this op amp vary from +14 to −14 volts.

The power supply requirement is +15 volts at 1 amp. The negative supplies do not need to be high current regulators. Two are required: −5 volts and −15 volts. If your YIG is an HP type, you will need to add a −10 volt regulator.

Before I get into the drive circuit I thought I would provide you with some details on other YIG pinouts that I have run across. I don't know if you can locate the same type I have, but the information should prove helpful. For the Hewlett-Packard 2–6 GHz YIGs, power goes to a 14-pin DIP socket on top. Pin 1 is ground, pin 3 is +20 volts, pin 6 is −10 volts, pin 10 is the main coil positive terminal and pin 11 is main coil negative. The 3.8 to 6 GHz HP YIG pinouts are the same, with the addition of pin 14 being the FM modulation drive input pin.

John W7HQJ, who designed these driver circuits from multiple sources, is happy to share this project with the experiment-oriented amateur. The circuit is as simple as possible, while still making a very useful YIG sweeper/driver.

Circuit Description

Op amp U1a, an isolation amplifier in the sweep output, couples into the summing amplifier, U1b. U3a, another isolation amplifier, is in the voltage divider, the center frequency control. The high and low limit potentiometers there are relay-selected in each of the three different frequency ranges.

The details of multi-YIG switching aren't in the schematic. U2 and Q1 are the YIG driver current source, with Q1 connected as an emitter follower. This increases the current driving capability of U2 to the high values most YIGs need. The current limiting resistor in the emitter lead (25 ohms) is suitable for YIGs drawing about 180 mA. You need a 10 ohm resistor for 800 mA YIGs.

The comparator U3b serves as a fail safe should the operator turn the center frequency controls too high for the YIG. It samples the voltage on the wiper of the center frequency control, and when the voltage exceeds the desired threshold, it's directed to a high value current limiting resistor. Everything stops until the center frequency potentiometer is returned below this threshold.

Construction is straightforward. You can use perf board. In the future I may do a PCB layout for the circuit. It's my way of doodling in my spare time.

The leads for the YIG oscillator should have ferrite beads slipped over each end of the magnet driver coil leads. And, if you want to do CW operation, you need to put a large capacitor across the coil, to swamp out coil resonance. Keep the power supply leads short and well-bypassed. I usually grab a handful of 0.01, 0.1 and 10 µF capacitors, and sprinkle them around generously to minimize stray signal interference. It's a cheap fix. Rather than trying to find the lead that's making trouble, I bypass all the leads.

Mailbox Comments

The Ventura ARC wrote me of their latest laser QSO. Dick WA6JOX at Pumpkin Center and Steve WA6EJO at Mt. Pinos, California, 32 miles apart, easily pointed the laser at each other after determining accurate locations with 10 GHz "beam" headings. The laser receiver was constructed out of 4-inch PVC pipe with a front lens and a C7138 photomultiplier for the laser light detector. Dick stated that flashing spotlights in the direction the X-band signals came from helped, and he could easily see the bright light on Mt. Pinos; but the crew on Pinos had difficulty sorting out his spotlight from nearby city lights.

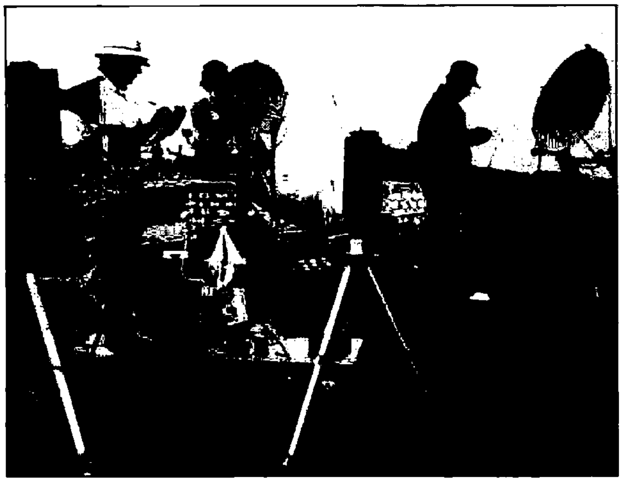


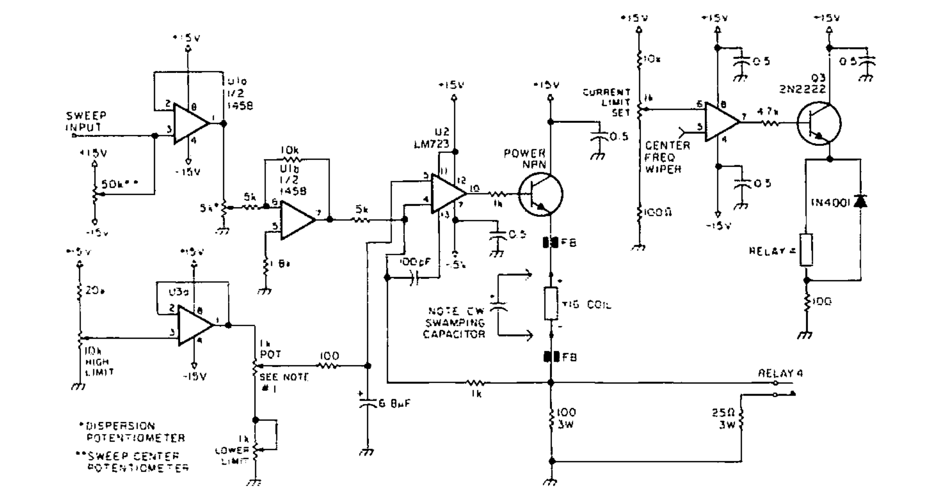
Photo A. Some members of the San Diego Microwave Group during the 1990 10 GHz contest on Mt. Soledad. Left to right: John WB6BKR, Kerry N6IZW, and Chuck WB6IGP. Photo by Bert K6BTO.

Aimed at each other, the lasers were bright even at 32 miles distance. Very little flicker from atmospheric disturbance was noted. The lasers used were 2.5 mW, HeNe (helium neon) which operate at a frequency of 474 THz, or, if you prefer, *474,000 GHz*! Quite an accomplishment.

Jack VE4JX is putting an IF and 10 GHz wideband system together using parts of an Alfa burglar alarm system. As microwave materials are scarce in Canada, he needed help obtaining parts. Using the *RSGB Handbook*, Jack is constructing a Gunn cavity.

Got to apologize to Paul KØIWA. I sent him a kit for the 30 MHz IF amplifier ("10 GHz Fun" in the April 1990 issue). The problem was I forgot to include the PC boards. Must have had toooo much sugar in my coffee that morning. By the way, Paul's call is especially great for an amateur living in IOWA.

Steven of Steven Coakley Video Microwave Services, referring to my August 1990 column, says it can be simple to receive commercial microwave transmissions. All you need is an SSB communications receiver. After tuning in, you demodulate the video output of the microwave receiver. A similar system is used in satellite communica-



Note 1: Center frequency control. You can select three YIGs for different frequency ranges by individually selecting them via relays along with different high and low limit pots. The schematic shows the hookup for just one YIG device.
Note 2: Relay 4 is normally closed. If the current goes too high (actuated by the comparator from the center frequency control) the relay drops out to provide a higher value of YIG current-limiting resistance.
Note 3: Bypass all IC power leads with 0.5 µF capacitors to ground.

Figure. The spectrum analyzer driver and out of range current limiter; John Petrich W7HQJ, 9/90.

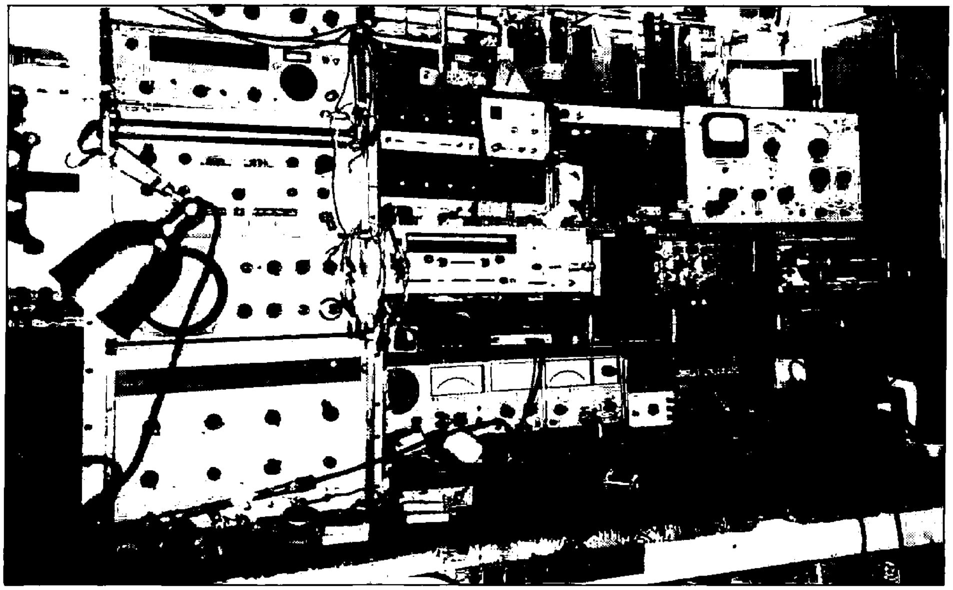


Photo B. WB6IGP's work bench, always cluttered, always changing.

tions to send long distance calls.

The video has all the SSB channels stacked from about 20 Hz to about 8 MHz. Steven suggests the book, *The Hidden Signals on Satellite TV*, by Thomas P. Harrington and Bob Cooper Jr., available from Howard Sams Publishing or through "Uncle Wayne's Bookshelf."

Well, Steven, if the signals are analog in nature, you can receive them. This scheme is used to transmit and receive microwave voice channels. I did a poor job of trying to explain analog and digital. Analog systems seem to be in decline, with most systems going digital. Digital format makes reception dependent on a digital terminal of similar type. There are test sets to do this, but none yet in surplus.

Myron KA9THG liked the switching power supply article in the August 1990 issue, and thanked me for helping him solve a problem. He had been looking for a simple way to run his printer on 12 volts DC. He had a bushel of old CB power supplies, and would you believe, the transformer he found is just what the doctor ordered—110 primary and 24 volts secondary. One thing: Watch out for spiking on the drains of the FETs. I used a series 0.1 μF capacitor and a 5 ohm resistor to minimize spiking. The formula for circuit frequency is TC = 4.40 times (R • C), or TC (60 Hz) = 4.4 • (38k • 0.1 μF). In actual tests, some variations in the capacitor suggest slightly higher values (+0.01 μF) to trim to proper frequency.

Alva KD4BH also wrote to me about this article, wondering why I didn't include a schematic. Well, Alva, I just forgot to send it in for that column. See the *Updates* section in this issue for the schematic.

That's it for this month. Next month, with the help of Steve WA6EJO, we'll explore laser communications. As always, I will be glad to to answer any questions related to our VHF/UHF microwave bands. Please send an SASE for prompt reply. 73's Chuck WB6IGP

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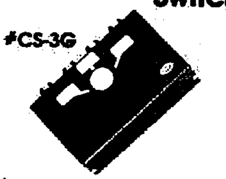

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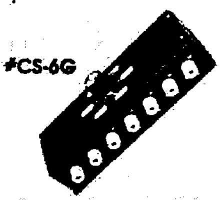

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

MAY 4

OSWEGO, NY The Southern Tier ARC will host the Southern Tier Hamfest from 8 AM-4 PM at Marvin Park Fairgrounds. 32nd Annual Banquet, VE Exams, Flea Markets. Tickets are $3 in advance, $4 at the gate. Tailgating $2 extra; tables $15. Banquet (includes general admission) $18 per person in advance. Contact *STARC, PO Box 7082, Endicott NY 13760*. Talk-in: 146.16/.76 or 146.52.

CEDARBURG, WI The Ozaukee RC will sponsor the 13th annual Cedarburg Swapfest from 8 AM-1 PM, at the Circle-B Rec. Center, Highway 60 & County I. Advance tickets $2, $3 at the door. 4' tables $3. Set-up at 7 AM. License exams start at 9 AM. Talk-in on 146.37/.97 and 146.52. For reservations and info, send an SASE to *ORC Swapfest, 11448 Laguna Dr., Mequon WI 53092. (414) 242-4995.*

BEMIDJI, MN The Paul Bunyan ARC will hold its annual Hamfest from 7 AM-3:30 PM at the Moose Lodge. VE Exams. Talk-in: 146.13/.73. For info call or write *Don Ilies NØMAZ, R.R. 2 Box 187AA, Bemidji MN 56601. (218) 751-9254.*

MAY 4-5

ANDERSON, SC The Blue Ridge ARS will sponsor the Greenville Hamfest/Electronic Flea Market at the Anderson County Fairgrounds from 8 AM-5 PM Sat.; 8 AM-3 PM Sun. Walk-in license exams. Camping, free parking. Set-ups with advance registration. Advance tickets $4, $5 at the gate. For tickets, info, send SASE to *Blue Ridge ARS, PO Box 6751, Greenville SC 29606.*

SIERRA VISTA, AZ The Cochise ARA will hold its annual Hamfest at the club training facility, 5 miles east of town on State Rte 90, then 2 miles south on Moson Rd. All ham radio, computer and related businesses are invited. Free tailgating. VE Exams. Overnight RV camping for club members (no hookups). Facilities for the handicapped. Talk-in: 146.52 or 146.76 (−.6). Contact *N7INK (602) 378-3155* after 6 PM, or write to *CARA, PO Box 1855, Sierra Vista AZ 85636.*

MAY 5

SANDWICH, IL De Kalb Hamfest, sponsored by Kishwaukee RC, will be held at the Sandwich Fairgrounds, beginning at 8 AM. Set-up at 6 AM. Overnight camping, no hookups. Tickets $4 in advance with 2 stubs. After Apr. 15th, and at the gate, $5. Tables $10 each. Tailgate space free with paid ticket. Talk-in on 146.13/.73 and 146.52. For reservations, make check payable to KRC and send with an SASE to *Howard Newquist WA9TXW, PO Box 264, Sycamore IL 60178.*

ALEXANDRIA, VA Fairfax Computer Fair/Flea Market will be sponsored by the Thomas Jefferson High School for Science and Technology PTSA, in conjunction with the Capital PC User Group. The proceeds will go to benefit computer oriented education. This event will be held at the Thomas Jefferson High School from 9 AM-4 PM. Contact *Mark Bakke, (301) 530-1303* or *Mort Rau, (703) 754-9859.*

ST. PETERSBURG, FL The St. Petersburg ARC will sponsor a Hamfest at Lake Maggiore Park from 8AM-3 PM, rain or shine. Free parking. No tailgating. VE Exams from 10 AM-2PM. Admission $4, kids under 12 free. Set-up at 7 AM. For registration: *Otto Suplski WB2SLO, (914) 969-1053.*

YONKERS, NY The Metro 70cm Network will hold a Giant Electronic Fleamarket at the Lincoln High School from 9 AM-3 PM. Free parking. VE Exams from 10 AM-2 PM. This is one of 3 Giant Electronic Flea Markets. The other two will be on Sept. 29th, 1991 and Jan 19th, 1992. Sellers can get ½ price by registering for all three events and paying the full amount in advance. Deadline dates are 5/3/91, 9/10/91, 1/8/92. Registered tables $15 for the first, $10 for each additional. Bring your own table at $1.80 per foot. $10 minimum. Tables $20 at the door, $2.50 per foot. Reserved tables and space will be held only to 9 AM. No refunds without notification of cancellation 72 hours in advance of each event. Admission $4, kids under 12 free. Set-up at 7 AM. To register, call *Otto Supliski WB2SLO, (914) 969-1053.*

MAY 11

MANITOWOC, WI The Mancorad RC will hold its annual Hamfest from 8 AM-5 PM at the Manitowoc County Expo Ctr. Flea Market (amateur, computer, SWL). VE Exams. Advance tickets $2, $3 at the door. 8' tables $3, with electric outlet $8. SASE to *Mancorad RC, PO Box 204, Manitowoc WI 54220.*

SPRINGDALE, AR The Northwest Arkansas ARC will hold "HAMFEST 91" at the Rodeo Grounds Community Building from 8 AM-4 PM. Free admission. Tables $5 each, advance registration required. Tailgating $4 per vehicle. Free parking. Talk-in on 146.76 (−.600). Contact *Jim Henington KB5ITL, PO Box 278, West Fork AR 72774. (501) 839-2488 after 4:30 PM. Via packet KB5ITL @ KA5BML.AR.USA.*

MAY 12

ATHENS, OH The Athens County ARA will hold its 12th annual Hamfest at the City Rec. Center from 8 AM-3 PM. Admission $4 per ham, spouses allowed in free. Free Tailgating space. Indoor space by advance registration only. For info write to *Carl J. Denbow KA8JXG, 63 Morris Ave., Athens OH 45701.* For registration contact *John Biddle WD8JLM, 80 Wonder Hills Dr., Athens OH 45701. (614 594-8901 after 6 PM.* Talk-in: 145.15/.55 MHz.

MAY 18

FORESTDALE, RI The Rhode Island Amateur FM Repeater Service, Inc. will hold their annual Spring Auction and Flea Market at the VFW Post 6342. The Flea Market starts at 8 AM, spaces are $5 each. The Auction will be from 11 AM-3 PM. Free admission. Talk-in on 146.76. Contact *Rick Fairweather K1KYI, PO Box 591, Harrisville RI 02830* or call *(401) 568-0566* between 7-8 PM.

EPHRATA, PA The Ephrata Area Repeater Society, Inc. will hold the Lancaster County Hamfest at the Ephrata Senior High School beginning at 8 AM. Set-up at 6:30 AM. Handicap accessible. Admission $4, Tailgating $3, Tables $6. Talk-in on 145.45, 146.52 and 444.65 MHz. For info/reservations contact *Tom Youngberg K3RZF, (215) 267-2514* after 6 PM, or write, *E.A.R.S., 906 Clearview Ave., Ephrata PA 17522.*

DEWITT, IA The Clinton ARC will hold "HAMFEST 91" at the 4-H County Fair Grounds starting at 8 AM. Set-up at 6 AM. Over-night security. Talk-in: 147.06 and 145.430. VE Exams start at 9 AM. ATV and DX packet cluster seminars. Contact *Darryl Petersen KDØPY, RR1 Box 84, Bryant IA 52727.*

CADILLAC, MI The Wexaukee ARA will sponsor their annual Swap and Shop at the Cadillac Middle School from 8 AM-1 PM. Admission $3., tables $6. Talk-in on 146.38/.98 repeater. Contact *Dan Schmidt KE8KU, (616) 775-0998*, or write, *Wexaukee ARA, PO Box 163, Cadillac MI 49601.*

MAY 19

WABASH, IN The Wabash County ARC will hold its 23rd annual Hamfest at the Wabash County 4-H Fairgrounds from 6 AM-4 PM. Free overnight camping. Advance tickets $4.50, $5 at the door. Amateur exams will be given for Tech-Extra by the North Central Indiana Examiner Team from 8 AM-Noon. Talk-in: 147.63/.03, 148.52/.52, 146.94/.94. For ticket info send SASE to *Don Spangler, 235 southwood Dr., Wabash IN 46992. (219) 563-5564.*

PEOTONE, IL The annual Hamfest sponsored by the Kankakee ARS will be held at the Will County Fairgrounds from 8 AM-2 PM. Set-up 6 AM-8 AM. Free parking. Overnight RV parking, no hookups. Advance tickets $3.50, $4 at the door. Talk-in on 146.34/.94. Contact *KARS, C/O Frank DalCanton KA9PWW, 117 Kristina Dr., Bourbonnais IL 60914. (815) 932-5950 after 7 PM CST.*

MAY 25

DURHAM, NC The Durham FM Assn. will hold its 18th annual "DUR-HAM-FEST" under the south parking deck of the South Square Mall shopping center. Wheelchair accessible. VE Exams contact: *Pete Goolsby KY4Y, 120 Radcliff Circle, Durham NC 27713, (919) 544-3215.* Advance tickets are $4, $5 at the door. Please SASE with your order to *R.P. Buehlmann N4IQA, 1314 Chaney Rd., Raleigh NC 27606. For table info and registration contact* Thomas D. Ferrell WA4MWT, 3012 Glendale Ave., Durham NC 27707, (919) 220-5018, *or* Sid Edwards W4QWM, 1700 High St., Durham NC 27707, (919) 489-2933. *To reserve space and advance tickets, contact Sid Edwards W4QWM, (919) 489-2933 before 9:15 PM.*

MAY 26

WEST FRIENDSHIP, MD The Maryland FM Assn. will sponsor its annual Memorial Day Hamfest (for amateur radio related items only), at the Howard County Fairgrounds from 8 AM-3 PM (premises must be cleared by 5 PM). Talk-in on 146.16/.76, 223.16/224.76 and 449.00/444.00 WA3DZD repeater. Donation $4, tailgating $3. Tables $15 in advance, $20 at the door (if available). Only PAID table reservations accepted. Make checks payable to MFMA, Inc., and SASE to *Melvin Seyle WA3KZR, 15809 Pointer Ridge Dr., Bowie MD 20716, (301) 249-6147.* Commercial vendors must have proper tax/license certificates available. All proceeds will be used to improve the Club's repeater system.

CHICAGO, IL Chicago ARC will hold the annual Hamfest at De Vry Inst. of Tech., from 8 AM-3 PM. Set-up at 6 AM. Tickets $3 in advance, $4 at the door. Write to *CARC, 5631 W. Irving Park Rd., Chicago IL 60634.* Or call *(312) 545-3622.* Talk-in 147.225 +600 PL.

SPECIAL EVENT STATIONS

MAY

VERMONT Throughout the year, Special Event Stations from Vermont will be operating 25 kHz up from the bottom of the Novice and General bands to help celebrate Vermont's 200th Anniversary. RTTY/AMTOR/etc. will be in the digital sub-bands. To obtain a special Certificate, send $1 and a SASE to *Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.* Foreign stations, send only SAE and IRC's, to cover postage.

MAY 3-12

SACRAMENTO, CA The California State Railroad Museum will operate WB6RVR from the Central Pacific Depot in Old Sacramento, May 3rd-May 12th, 1600-2400Z during "RAILFAIR '91," to commemorate the Museum's 10th anniversary. Frequencies: Phone 7.270, 14.270, 21.370, and 28.370 MHz. For commemorative QSL, send your QSL and No. 10 SASE to *California State Railroad Museum, Attn: Steam Trains, 111 "I" St., Sacramento CA 95814.*

MAY 4

GRANTSBORO, NC The Ol' Country Fair of Pamlico Community College will operate N4WRR from 1400-1900Z to commemorate the 17th annual Fair. Operation will be 25 kHz up from the General band edges and the Novice 10 meter phone band. Send QSL, QSO number, and SASE to *N4WRR, PCC, PO Box 185, Grantsboro NC 28529-0185.*

MAY 4

BAYONNE, NJ The Bayonne Emergency Management ARC, sponsored by the City of Bayonne, NJ, will operate W2ODV from 1200 UTC-2400 UTC on May 4th and 1200 UTC-2400 UTC on May 5th. Operation will be on all bands from 80 meters through 440 MHz, with concentration in the Novice and General class portions. Each club member will sign their own call followed by "BEMARC Special Event Station." To receive a special Certificate, send a QSL card with an 9 X 12 SASE and one unit of postage (or one IRC) to *BEMARC, c/o John Anzivino, 236 Pearsall Ave., Jersey City NJ 07305.*

MAY 10

PROMONTORY, UT The Odgen ARC will operate W7STB from Promontory Summit, to commemorate the 122nd year of the driving of the Golden Spike, from 0001Z-2100Z. Frequency will be on one of the following: 3.970, 7.270, 14.280, 21.375 or 28.415 MHz. Send QSL and SASE to *Ogden ARC, PO Box 3353, Ogden UT 84409.*

MAY 11-12

LAS VEGAS, NV The Nevada QSO Party, sponsored by the Frontier ARS, will be held from 0000Z May 11th-0600Z May 12th. Frequencies: 6 through 160 meters. Modes: CW/SSB/RTTY/SSTV/Packet. Scoring: 1 point for Phone QSO; 2 points other modes. Nevada stations multiply by state/province/country total. Non-Nevada stations multiply by number of Nevada counties. Awards: Certificates to top score of each state/province/DXCC country. Mail entry by June 1st, 1991 to *Jim Frye NW7O, 4120 Oakhill Ave., Las Vegas NV 89121.*

MAY 11-19

HOLLAND, MI The Holland ARC will operate K8DAA to celebrate Tulip Time. Frequencies: Low end of General bands on 15 and 20 meters, and 28400 on 10 meters. For Certificate, just work two HARC members or the Club station. Send QSL card with calls worked and SASE (legal size or 9 X 12) to *Dave Lamer WA8RSA, 2866 E. Chester Dr., Zeeland MI 49464.*

MAY 12-17

DAVIS MTNS, TX Amateur astronomers/hams representing the Southwest Region of The Astronomical League, will operate K5GH at the 10th annual Texas Star Party, located near the University of Texas' McDonald Observatory in the Davis Mtns., from May 12th-17th. Frequencies: (±QRM): 28365, 21365, 14265 and 7265. SSTV and CW contacts on request. For an astronomical-theme QSL card, send QSL and SASE to *K5GH-TSP, 721 White Dr., Garland TX 75040.*

MAY 18

HANFORD, CA The Kings ARC will operate AA6GZ, 1600Z-2200Z, to commemorate the Centennial Anniversary of Hanford, CA. Frequencies: The General 10, 15 and 20 meter phone and the Novice portion of 10 meters. For a certificate, SASE to *KC6HVE, PO Box 548, Armona CA 93202.*

MAY 18-19

CHICAGO, IL The DuPage ARC will operate Club station W9DUP, to commemorate Armed Forces Day. Operation will be from the U-505 submarine at The Chicago Museum of Science and Industry, Sat. & Sun. from 1600 UTC-2300 UTC. Frequencies: 7.250, 14.290, 28.400 SSB and 145.25 (−.600). For a certificate, send QSL and SASE to *Jack Carr NV9S, DARC, PO Box 71, Clarendon Hills IL 60514.*

ST CHARLES, MO The St. Charles ARC will operate WBØHSI from 1300Z-2100Z as part of the Lewis and Clark Rendezvous. Frequencies: 7250, 14250, 21350, 28410, and 146.67, as conditions permit. For 8½ X 11 certificate, send a large SASE to the *St. Charles ARC, PO Box 1429, St. Charles MO 63302-1429.*

LONG BEACH, CA The Hollywood Chapter of the Lambda ARC will operate K7OO from the site of the annual cultural pride festival, adjacent to the Queen Mary in Long Beach. Frequencies: General portions of the 40, 20, and 15 meter bands and the Novice portion of the 10 meter band. For a special QSL, send a QSL card and business size SASE to *LARC, PO Box 91299, Long Beach CA 90809.*

MAY 28

ANNAPOLIS, MD The United States Naval Academy ARC will operate the Club station, W3ADO, from 1300Z-1800Z, to celebrate commissioning week at the Naval Academy. Operation will be in the lower 50 kHz of the General and Novice phone bands. For QSL, send QSL (no SASE) to *Peter Erpelding WB6MXL, 14D Sellers Rd., Annapolis MD 21402.*

Number 29 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525-4438, 8 data bits, 0 parity, 1 stop bit. Thank you for your cooperation.

I need the manuals for the Yaesu FRG-7 receiver. I will pay copy and postage costs. *Tom Francis KB5OCU, RT 2 Box 336, Leonard TX 75452. (903) 568-4698.*

I need a schematic or other printed material on a Pace FM 152 VHF transceiver. It is presently tuned to 156 MHz and I would like to retune it to the 2 meter band. I will appreciate any help I can get on this project. Also, does anyone know the address of Pace Comm. Div., or PATHCOM, Inc.? Thanks. *B.T. Jeavons WA6GEF, 5825 Cedar Rd., Ocean Springs MS 39564.*

I need a schematic and/or manual for an EICO oscilloscope Model 470. Also, a bathtub cap for same: 2X.5 MFD 1500VDC. *William R. Bogart KA9CWK, RR2 Box 50B, Covington IN 47932.*

I am looking for the manufacturer of a beam antenna. It is wound on fiberglass rods and is wound with copper tape instead of loading coils. *Pete Anderson W5VYV, 1209 W. Cochiti, Hobbs NM 88240.*

Wanted: A Model J-37 CW aircraft key for display in a WW2 aircraft radio museum. A small sign indicating the name of the donor will be placed next to the key in the museum. *Bill Pearce W0MWO, Eagles Rest, 9 Knightsbridge Place, Pueblo CO 81001-1434. (719) 544-0691.*

I would like to exchange operating and maintenance ideas with anyone still operating Hallicrafter's HURRICANE transceivers. Please contact *R.P. Paulukonis KB1TY, PO Box 321, Strafford NH 03884.*

Wanted: Teletype LPR35BWA w/LRB23 base, LMU4 motor and LBAC255BR cabinet. *Charles T. Huth, 229 Melmore St., Tiffin OH 44883 (419) 448-0007.*

The Dayton ARA is now accepting applications for the 1991 Scholarship Program. There will be eight $1500 scholarships available this year. The program is open to any FCC licensed amateur operator graduating from high school in 1991. There are no restrictions on class of license or planned course of study. For application forms and information, write to *DARA Scholarship Committee, 317 Ernst Ave., Dayton OH 45405.*

Teacher of developmentally-disadvantaged high school students would appreciate donation of books on audio and RF equipment construction and design, intended for home-brewers (no college engineering texts please). Cannot accept equipment, magazines, or books that are moldy. I will reimburse shipping at *cheapest* commercial rate (book rate, first class, or UPS). *Douglas Conley, c/o Conley Vision, 12008 W. 87 St. Pkwy., Lenexa KS 66215.*

Wanted: Operating manual (or photo copy) for the Hickok Model 752-A tube tester. I will pay all costs and postage. *Hal Smith W2GKE, 26 Linden St., Bayonne NJ 07002. (201) 436-1405.*

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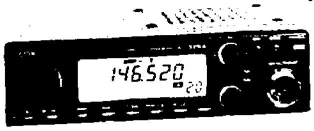

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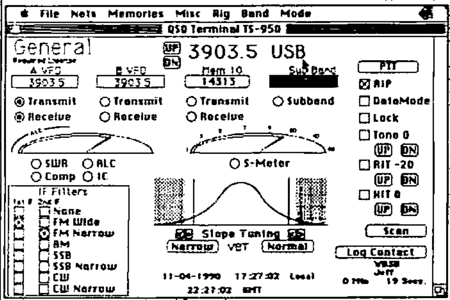

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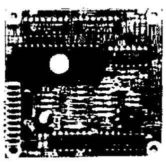

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CIRCLE 17 ON READER SERVICE CARD

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73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy
N. Swanzey NH 03431

Notes from FN42

Good news as I am writing the column; the fighting in the Persian Gulf has ended. I have made an effort to not write about what has been happening, but I read in a recent Wall Street Journal *that there was ham activity from Kuwait during the conflict. It will be reported under the Kuwait banner in "Roundup."*

This month's column is colorful, with pictures from the Greek climbers shown in last month's issue, the QSL card from Olimpiada Cultural Barcelona '92, a photo of Byong-Joo Cho HL5AP and his family, and letters from Rod Hallen 5Z4BH and Woodson Gannaway N5KVB/EA.

And now, on with the show!

—Arnie N1BAC.

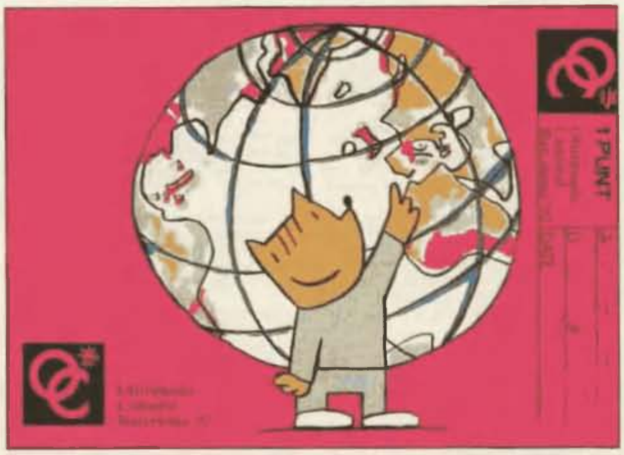

Photo B. QSL card for the Olimpiada Cultural Barcelona '92

Photo A. Our Hambassador to South Korea, Byong-Joo Cho HL5AP, and his beautiful family.

ROUNDUP

Japan From *The JARL News*: "Radio Amateur Becomes Minister of Posts and Telecommunications," reads the headline. Mr. Katsutsugu Sekiya JA5FHB, a member of the House of Representatives, was welcomed and honored as the new minister by 200 JARL members. Mr. Shozo Hara JA1AN, President of JARL, expressed his congratuations and sincere expectations for Mr. Sekiya's good role for further promotion of amateur radio in Japan.

Mr. Sekiya acquired his first amateur radio license in 1970, and he is one of the founding members of Diet Ham Club, JG1ZQU, which consists of 21 members of the House of Representatives, 1 member of the House of Counselors, and 59 members of the Diet staff.

On another note, Ginowan City in Okinawa has been selected as the site for JARL's 33rd General Assembly, scheduled to be held on Sunday, May 26, 1991.

The Annual General Assembly is that time of the year when all participating members reflect upon JARL's activities and operations, and in so doing promote mutual understanding. It is also an important meeting where the pros and cons of yearly programs, as well as the all-important budget, will be discussed and resolved, hopefully to the eventual satisfaction of all members.

Kuwait From *The Wall Street Journal*, March 4, 1991, dateline Kuwait City, Kuwait. This article describes how some of the Kuwaitis made it through the crisis by bartering food and material things.

One of the families mentioned was the "Sultans," a prominent merchant family. They asked that their real surname not be published because they fear for the lives of three family members still held by Iraq. Amiri, mentioned in the following paragraph, is a member of that family.

"In one way, the Sultans did continue to defy the occupation directly. Seated at the computer in his basement, one of Amiri's cousins, a ham radio operator, continues to this day to run one of the few communications links with the outside world. Mostly, he has sent out personal messages to Kuwaitis abroad. Several months into the occupation, the Iraqis compiled a list of hams and made a sweep of their equipment. Amiri's cousin politely greeted the soldiers at his door and handed them an antiquated piece of radio gear. Meanwhile, Amiri continued broadcasting from his basement. He also piled boxes of food at his door to distract future visitors on similar missions."

[Not every member of the "Sultan" family or other families were as lucky. Some were killed and some have been taken and not heard from since. Let us all pray that those missing will be returned safely, and that the crisis in the Middle East will be solved to the satisfaction of ALL.

—Arnie]

Photo C. SV2AHJ, of the Greek Mountaineers' Club, QSOing with the GCR250 HF rig. WOW! What a view!

KENYA

Rod Hallen 5Z4BH
AMEMBASSY Box 55A
APO New York 09675

Since the 20th of September I have only spent two weeks in Kenya. The rest of that time I was in the U.S.A. or traveling in East Africa.

Just before I left Nairobi for the states, my landlord informed me that he was going to put a new roof on my house while I was gone. So, I had to take all of my antennas down, and I haven't been on the air since, except for the local 2 meter repeater. I have a week off so I hope to get at least my G5RV back up. Unfortunately, the new roof is peaked and made of aluminum, where the old one was flat concrete.

I'm due out of here *[Kenya]* one year from now, and have just sent in my bidlist. On that list is Cairo (SU), Karachi (AP), Bonn (DL), and Miami (W4?). I took a trip to Bahrain (A92) early in September, and stopped off in Cairo for a few days to look the place over. I liked what I saw, so put it at the top of my list. Pakistan is also a good assignment, except that they refuse to issue ham licenses to foreigners. However, I have a good friend, Ben 5Z4BG, who has already received that assignment, and he will do what he can to remedy the situation. We'll see.

I was looking at the list of Hambassadors, and I have been in about half of those countries, but I've only met one of the Hambassadors personally. *[Me, too! Hopefully there will be more.—Arnie]* While I was stationed in Manila from 1981 to 1985, I used to visit Hong Kong quite regularly. In fact, it is still my favorite place in the whole world. In any case, I got my VS6 license with the help of Hambassador Phil Scott VS6CT, and operated from his QTH on a number of occasions. That was before he moved to the fancy new QTH that I saw pictured in a recent issue.

I'll pass along some info on what is happening out here as soon as I get back into the swing of things. 73.

SPAIN

Woodson Gannaway N5KVB/EA
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de G.C.)
Islas Canarias, Espana

Even though I still have the same restrictive antenna situation, I'm looking for more contacts with my friends in the Americas, both North and South. And to spread the word maybe my editor will let me run a column or two in Spanish to see what we can stir up. *[What do you readers think?—Arnie]* Sometimes we forget how much we lose by assuming that everyone speaks English. True, English is the official language of all hams, is universally used in the sciences, and was recently selected as the official language for the European Common Market, but it is not our job to rub people's noses in it! If you want to be a friend to someone, you can pay them no greater compliment than to learn their language, and work, really work, to understand their culture. It is an adventure.

Christmas Day I visited the Soviet training ship *Sedov*, a beautiful 4-master. Right, a sailing ship. I've got a soft spot in my heart for them, and I've waited for over two years for the chance to visit one. This time it finally worked out, and I spent a pleasant hour and a half with her.

I spent a few minutes with the radio officer, Igor, who spoke passable English. He showed me the radio room and the inside of one of their Russian-made transmitters. It was extremely well laid out and well made. Big and heavy, he said. On a ship that is no problem, I replied. He was extremely pleasant and I'm sure he spoke other languages, and once again, I was humbled by the thought of our unspoken attitude of superiority in assuming that the world should speak English, and we ourselves shouldn't exert ourselves in the least to learn other languages. Here I am with only two languages, trying to decide which will be the third.

The *Sedov* carries a crew of 195, of which 123 are cadets, and has an overall length of 117.5 meters. In 1982 she achieved a world speed record of 18.5 knots for her class. She was launched in 1921 as the *Magdalene Vinnen* under the German flag. In 1946 she was acquired by the USSR. She carries 17 sails; I almost got to see her set sail to depart, but had to go teach a class instead.

This year or next, I will be retiring my N5KVB/EA call for an EA8??? call for the rest of the time I live here in Spain. The residency papers are finally coming through, and that will be the practical effect in this area. Now I'll have to find other ways to effectively discourage people from using me just as a means to get a QSL card from EA8-land. Where there is a will, there is a way. I do run Morse in Spanish, and I might try that on them. I've taken Wayne's advice and developed a remarkable ability to not give signal reports even when asked over and over again. I guess it is a form of selective hearing; because if you ask or want to tell me about your hopes and dreams, what is new in your area (I asked a Czech ham that and he didn't let up for fifteen straight minutes!), or what you're excited about, they just don't make QRM that can keep me from hearing you. Unfortunately I do get wiped out by a lid once in a while, like anybody else.

A friend is checking out the situation of the 500th commemorative voyage of Columbus in 1992 as it relates to ham radio. Hopefully she will come up with something for us. Other than that, a Happy New Year *[A little late but well-meaning.]* to all of you, with strong wishes that whatever happens, it leads us closer to the world peace and unity that we all need and pray for. 73 once again, Woodson.

CIRCUITS

Number 31 on your Feedback card

Great Ideas From Our Readers

Field-Strength Meter/Carrier Alarm/Sidetone Monitor

A field-strength meter has many uses. Besides the normal functions of checking the field around an antenna and measuring the front-to-back ratio of a beam, it is also handy in the shack. A glance at the meter when you key your rig shows that the antenna is radiating power. It can also be used when adjusting the antenna tuner for maximum output at minimum SWR, or minimum plate current if you use an amplifier.

A few junk box parts added to a standard field-strength meter will produce a loud audible signal when your rig—or your neighbor's—is keyed. Thus, it can also serve as a sidetone monitor. Many hams have separate transmitters and receivers, and often operate each on a slightly different frequency, including split operation. Unless they have sidetone monitors, operation can be difficult. An audible monitor like the one described here is somewhat loud (a piece of tape over the alarm unit will help), but it will enable you to send accurate CW.

I originally designed and built this instrument because the ham downstairs—my son Kraig WB2PLW—operates 100 watts, and our outdoor antennas are mere feet apart. What I needed was a carrier-operated alarm to warn me to ground my antenna, to avoid high levels of RF being pumped into my transceivers, whenever he decided to go on the air.

Figure 1(a) shows the result. I had already built a field-strength meter, so I merely added the few parts necessary for the audible signal. If you're building this instrument from scratch, a simpler and cheaper version is shown in Figure 1(b).

In operation, the 2N3904 transistor is cut off in the absence of an RF signal, and no current is drawn from the 9-volt battery. When a strong RF carrier is present, it is rectified by the 1N34A diode which places a positive bias on the transistor base, turning it on. The piezoelectric alarm forming the collector load draws between 8 and 12 mA through the transistor, and emits a loud sound. There is no noticeable time delay in the circuit; it will follow even a very rapid keying. An SPST switch controls collector operating voltage, so you can turn the audible section off while operating, as desired.

Any small NPN transistor will work in this circuit, as will any RF diodes. The 1N914 in the emitter is there to assure that the transistor remains cut off unless a very strong carrier is detected. This is necessary in some cases, if you are relatively near the transmitter tower of a local radio broadcast station. The "antenna" for the device can be several feet of wire, the length depending upon the strength of the carrier of your own or any nearby ham transmitting antenna. I use about 8 feet of hookup wire as an antenna for the meter. My transmitter is a 20-watter, and my son's runs 100 watts. My dipole and his antenna array are about 30 feet from my operating position.

The piezo alarm element I used is available for $1 from Hosfelt Electronics, Inc., 2700 Sunset Blvd., Steubenville OH 43952 (Cat. No. LERT) and operates from 2 to 12 volts DC. Any similar device will work as well, and you may have one in your junk box. The transistor, diodes, RF choke (if used) and bypass capacitor are not critical, and are available from Radio Shack and most mail order dealers, if you don't already have them in your junk box.

J. Frank Brumbaugh KB4ZGC
Buffalo NY

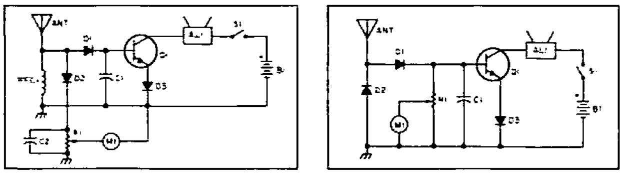

Figure 1. Schematics for the field-strength meter (a), and for the simpler version (b).

Parts List

C1, C2	0.01-0.25 µF disc, ceramic
D1, D2	1N34A, or equivalent
D3	1N914, 1N4148, or equivalent
M1	Surplus meter, 100 µA-1 mA
RFC1	1-2.5 mH
R1	5k or 10kΩ potentiometer
Q1	2N3904 (ECG123 equivalent)
AL1	Piezoelectric alarm unit
B1	9V battery

Covert Hamming

Continued from page 20

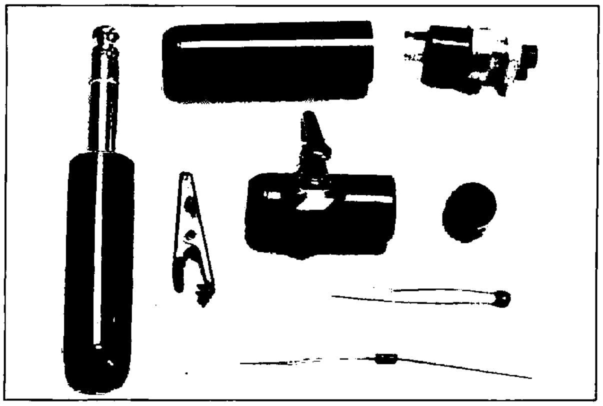

Photo C. Detail of the microphone and PTT assemblies. (Photo by Andy N6KAS.)

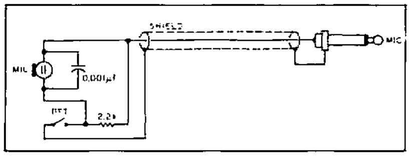

Figure 1. The original microphone wiring diagram.

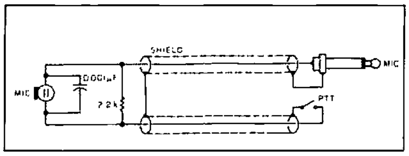

Figure 2. The modified covert wiring scheme.

three pins. Jumper the center pin to the pin which connects to the case, thereby creating a 2-pin element like the Radio Shack model.

After checkout, use a glob of silicon sealant where the wires enter the housings. This adds tensile strength.

You need some manual dexterity to solder the mike element. Be careful to avoid solder bridges and burned wires. Don't overheat the pins; there's an FET inside, and you could damage it!

Now that you've assembled your covert mike, just clip it onto your pocket or shirt collar and route the PTT switch down your sleeve or anywhere you can easily access it. Connect a small earphone to a mini-phono plug for receive and you're ready for some covert hamming (see Photos A and B).

The next time you're at a hamfest and you see someone talking to himself, it could be that he's been out in the sun too long . . . on the other hand, it could be that he's an Undercover Ham. 73

Eldon Ryan K6BRP can be reached at 22421 Ladeene Avenue, Torrance CA 90505.

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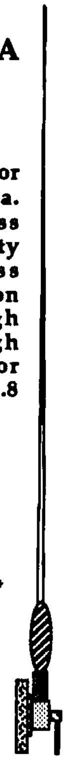

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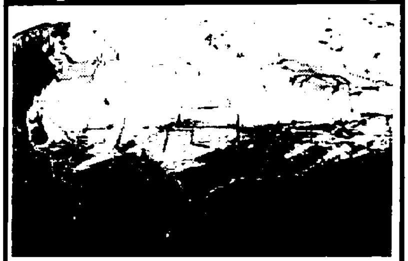

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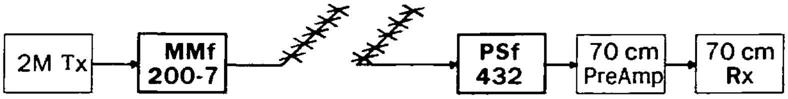

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RANDOM OUTPUT

David Cassidy N1GPH

Are You Having Enough Radio Fun?

A few months ago, Wayne came to me and said: "How about publishing a tabloid-type magazine, just for the newcomers to amateur radio? We could fill it with simple construction projects and easy theory articles so people could actually start to understand what they have memorized to pass the tests. We'd review every kit we could get our hands on, and we'd review all the latest gear from a Novice/Tech point of view. We could publish articles about how to get started in packet, ATV, moonbounce, microwaves, DXing, RTTY, satellites and all the other fun areas of ham radio. We could even reprint some of the great stuff from the 30-year history of *73*."

Well, of course I thought this was a great idea. You don't have to be a rocket scientist to understand most of the stuff we put into *73*, but we still get lots of letters asking for easier construction projects. Even some folks who have been hams for 20 years or more could benefit from a publication that's totally geared to the newcomer.

"What should we call it?" I asked.

"Hmmmm...," Wayne paused. "How about *Radio Fun*? It's short, would look good at the top of a masthead, and it describes the whole concept in two simple words."

"OK. Sounds great! How many new staff people do you think we should hire?" I asked.

"None."

"None?"

"None...at least for now. Let's just do it with the staff we have and see how it goes."

"OK," I said, though a bit less enthusiastically than before. It would be hectic, especially when both magazines came to deadline at about the same time, but the people who put together *73* every month are some of the best in the publishing business. They could handle it.

"So...I guess you want a business plan, advertising rates, a production schedule and all the rest." I started making a few notes on a legal pad. "When should we launch this? How about next fall?"

Wayne didn't miss a beat. "How about in 90 days...just in time for Dayton?"

You have to understand something about Wayne Green. He is not fond of being told why something can't be done. He is less fond of people who find problems without finding solutions. He also has very little patience with people who want to write reports, schedule meetings, "do" lunch or partake in all the other time-wasting activities that are a substitute for actually working in your average American business. I was trapped, and I knew it.

"We'll get right on it."

A New Ham Publication

For the past three months, the entire staff has been hard at work, making Wayne's idea of a newcomers' magazine a reality. Ads have been sold, columnists have been lined up, articles have been picked and edited, and the end result will...as Wayne "predicted"...be introduced at Dayton.

Radio Fun is for every ham, especially Novices and Techs, who wants to have more fun with amateur radio. We want to encourage everyone to upgrade, try a new mode or build a circuit. We want to give you the confidence to build a simple QRP rig and then go up on top of a mountain and have a ball with it. We want you to get involved with your local club, throw out all the old farts, and start promoting amateur radio as the fun hobby that it is.

Radio Fun will have monthly columns explaining radio theory. This is the stuff that most of us simply memorized in order to pass the test. Don't panic! This will be easy. If you follow the monthly column, you'll start to understand basic electronics and radio. Then we'll take you through the General class material, so your upgrade will be a snap. We've got Gordon West WB6NOA to write the monthly upgrade column. If you've ever been to one of Gordon's upgrade classes, or if you've even listened to his CW training tapes, you know that this is going to be fun.

Radio Fun wants you to have fun with whatever license you have. That's why we've got people like Carole Perry WB2MGP and Michael Geier KB1UM to write columns on all kinds of fun things to do. Bill Brown WB8ELK is going to help you get started in some of the less active modes like ATV, UHF/VHF DXing and microwaves. We want you to have fun with amateur radio, and we're going to show you how to do it.

You want simple construction articles? We got 'em! By the bushelbarrel-full! QRP rigs, antennas, test gear, station accessories...you name it, we got it. We'll make sure even a beginner can understand how to do it, and we'll always make sure that you can get the parts.

How about kits? We'll be reviewing every kit we can. We'll actually build them and report to you on how the kit rates. Are the instructions clear? Are all the parts included? Does the project work as advertised? Was the company available to help with any questions? This is the stuff you need to know BEFORE you buy a kit...and we'll tell you.

All product reviews in *Radio Fun* will be from a newcomer's point of view. We're even going to go back and reprint some reviews from the last 30 years of *73*. Since so many newcomers buy their first rig at a flea market, we figured it would make sense to publish reviews of this older gear.

The special premier issue of *Radio Fun* should be at your local ham store in a few weeks. It's a big, tabloid-sized newspaper, so you can't miss it. We'll also be sending them to as many hamfests and flea markets as we can. If you're a recent Novice or Technician, you just might get a free copy in the mail.

If you want to guarantee your copy of the premier issue, you have to subscribe BEFORE it is released. We're only printing a limited number, and when they're sold out...that's it. Check out the subscription ad in this issue of *73*. The charter subscription rate is only $9.97 for 12 issues. To sweeten the deal, we're collecting savings coupons from several advertisers. Everyone who subscribes at this pre-publication rate will receive at least $25 worth of coupons for all kinds of great products, including "buck-off" coupons for Uncle Wayne's Bookshelf. So you really can't lose.

Everyone at *73* is very excited about this new project, and we've received support from the biggest and best companies in the amateur radio industry. Now, all we need are readers. I hope you'll be one of them. After all...couldn't we all use a little more fun? 73

Number 33 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

A Mixed Bag

May is one of those months that lies between the excellent propagation of the spring equinox and the poorer HF DX of the summer solstice, and therefore exhibits both good and poor DX conditions. Usually, the better conditions exist closer to the first of the month, and the poorer conditions toward the end...but "usual" doesn't always mean this month and this year!

For example, just a few months ago, most propagation analysts were surprised by the "plateau" in sunspot numbers accompanied by a reduction of solar flux that lasted nearly six months. No one could safely predict what would happen...and Old Sol fooled us again, as just two weeks ago, he showed a solar flux well over 300, one of the highest in this cycle. Does this mean, then, that we may have a double peak, or what? No one knows. Theoretically, we should be starting on the down side of Cycle 22. And perhaps we are; but Old Sol may have a few surprises in store yet.

Specifically, for May, you can expect a possible few "Poor" (see the calendar) propagation days centered around the 7th or 8th, and again around the 16th. The last week or so is expected to be only "Fair" to "Poor." The "Good" days are anticipated between the 1st and the 5th, the 10th to 14th, and the 19th to the 22nd of May.

Keep your ears and receivers tuned to WWV for late predictions and recent changes in the flux levels so that you can take advantage of conditions as they occur. The 18-minute, after-the-hour broadcasts at 5, 10, or 15 MHz are the ones I use; most frequently, the one on 10 MHz. Remember that you want a LOW "A" index (below 10), and a high solar flux index (above 180). This is not to say that higher magnetic field indexes and lower solar flux numbers render the bands unusable; it just means that they won't be as good for DX propagation. See you next month! 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10	—	20	—	—	—	20	20	—	—	15	10/15
ARGENTINA	15	15/20	20	40	40	—	—	10	—	—	10/15	10/15
AUSTRALIA	10/15	20	20	20	20	40	20/40	20	—	—	—	10/15
CANAL ZONE	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
ENGLAND	20	40	40/80	40/80	40	—	—	15	10	15	15	20
HAWAII	10/15	15	20	20	20/40	20/40	20	20	—	—	—	10/15
INDIA	20	20	—	—	—	—	—	15	—	—	—	—
JAPAN	10	—	20	—	—	—	20	20	—	—	15	10/15
MEXICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
PHILIPPINES	15	—	20	20	—	—	20	10/15	10	—	—	15
PUERTO RICO	15	20/40	20/40	20/40	20/40	15	15	10	10	10	20	10
SOUTH AFRICA	20/40	40	20	20	—	—	—	—	10	10	15	15
U.S.S.R.	40	40/80	20	20	—	—	—	10/15	10/15	—	20	20
WEST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	15	20	20	20	—	20	20	—	—	—	10/15
ARGENTINA	15	15	20/40	20/40	20	—	—	10	—	—	10	10/15
AUSTRALIA	10/15	15	15	—	20	20/40	40	20	—	—	15	10
CANAL ZONE	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
ENGLAND	40	40/80	40	—	—	—	—	—	15*	15*	20	20
HAWAII	15	15	15	20	20	20/40	40	20	—	10	10	10
INDIA	15	15/20	—	—	—	—	—	10/20	15	—	—	—
JAPAN	10/15	15	20	20	20	—	20	20	—	—	—	10/15
MEXICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
PHILIPPINES	10/15	—	20	20	—	—	—	—	10/15	10/15	—	—
PUERTO RICO	15/20	15/20	20/40	20/40	20/40	—	—	10/20	10/20	10	10	10
SOUTH AFRICA	—	—	20	20	—	—	—	—	15	15	15/20	20
U.S.S.R.	—	—	—	—	—	—	—	15[1]	15[1]	15[1]	20	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	10/15	10/15	15	20	20	20	—	20	20	—	—	15
ARGENTINA	10/15	15	15	20	20	—	—	—	—	—	10	10
AUSTRALIA	10	10/15	15	15	20	20	20	—	20	—	—	—
CANAL ZONE	10	15	15/20	20/40	20/40	—	—	—	10	10	10	10
ENGLAND	20	20	—	—	—	—	—	—	15	15	15/20	20
HAWAII	10/15	10/15	15	15/20	20/40	20/40	40	—	15	10	—	—
INDIA	—	15	20	—	—	—	—	—	10/20	15	—	—
JAPAN	10/15	10/15	15	20	20	20	—	—	20	—	—	15
MEXICO	10	15	15/20	20/40	20/40		—	—	10	10	10	10
PHILIPPINES	10	10	—	—	—	—	—	20	15	15/20	—	—
PUERTO RICO	10	15	15/20	20/40	20/40		—	—	10	10	10	10
SOUTH AFRICA	20	20	—	20	—	—	—	—	—	10	15	15
U.S.S.R.	20	—	—	—	20	—	—	20	20	20	20	20
EAST COAST	20/40	20/40	20/40	40	40	—	—	10/15	10/15	10/15	10/15	20

* Try next higher band on "G" days (1) Possible opening on this band on "G" days (2) Try 80m
Note A: Use values of 10/15 for 12m, 20 for 17m, 40 for 30m Note B: The chart refers to the highest band possible at the time indicated. If no luck, try next lower band.

MAY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 G	3 G	4 G–F
5 F–P	6 P	7 P	8 P	9 P–F	10 F–G	11 F–G
12 F–G	13 G–F	14 F–P	15 P	16 P	17 P	18 P–F
19 F–G	20 G	21 G	22 G–F	23 F	24 F	25 F–P
26 F–P	27 P	28 P–F	29 P–F	30 P–F	31 P–F	

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LETTERS

From the Hamshack

Tim P. Yoho WA3D, Lock Haven PA I read several letters in the April issue concerning dissatisfaction with service from American manufacturers of radio products.

I wish to report a very positive experience with a U.S. company, namely Heath. I built the Heath SB-1000 linear amplifier and had a problem with the output. After much searching by myself and several other hams, I sent the unit back to the factory. The unit was returned several weeks later with a plate choke modification; it worked properly for a few days, then the original problem returned.

I wrote Heath about the problem, and the service manager immediately responded, requesting that I send back the unit. He indicated that Heath would reimburse me for the postage (which they promptly did), and give the unit priority treatment. Two weeks later, it came back with an RF choke and 3-500Z replacement at no charge. The unit has worked well since, and I am pleased with the attention and concern expressed by the service people at Heath.

James S. Waters W5YG, Houston TX Now that no-code is a reality, how about some "2 meter FM on a shoestring" like *73* had *years* ago? Let's show poor college students that they *can* afford this hobby.

It's already in the works!... Bill WB8ELK

Jim Kelly KK3K, Philadelphia PA I enjoyed the April editorial, as always. I chuckled at your comments about giving basically the same pep talk each year. I enjoy it nevertheless, because it is one of the few indications that there is life still left in the hobby! What a dull bunch we must seem to the uninitiated who stumble into Hara and cannot even get a response from the hoards glued to their HTs, stooped over tables full of connectors.

Ham radio's best kept secret is how much fun and how easy it is to work OSCAR. The sunspot cycle will soon start to decline, and I asked our club members, "What will you do then?" I pointed out that OSCAR-13 work is reliable, full duplex, not propagation-dependent, and requires small antennas. You can do satellite operation for the same amount of S or less than HF. It offers plenty of DX and rag-chewing, is relatively QRM and lid-free, and available to all hams with Technician class and above licenses. It's a great opportunity for fun in ham radio for our new codeless Technicians!

Doug Brock, Huron SD On March 2, I entered the Amateur Radio Service as a no-code Tech, and I'm proud of it. I had played with the idea of becoming a ham for about nine years, then about six months ago, I decided to get serious about it. I was studying for the Novice when the no-code class came up, so I grabbed a Tech book and went for it. I encourage anyone thinking about amateur radio to go ahead and go for it. But don't stop. Keep going up the ladder. I am.

As for guys like "N0" in the March issue, ignore him. There's always a few sour apples in the bunch. If you're tired of the garbage on 11 meters like I was, get out of there. The best of luck to anyone studying for that next test, for any class license.

Norris Carden, Shreveport LA I'm possibly the first of a group that some people fear will show up in mass and take over the precious ham bands. I'm a no-code Tech. I passed the written tests with just a little effort last February. To me, code was an unnecessary, and to some degree unreasonable, way of communicating.

I'm a professional broadcaster, and I've worked in radio as a DJ, newscaster, sports reporter, and program director. In TV, I've been a news photographer, reporter, director, and now a producer. My words, spoken by myself or by others on the air, are heard by thousands and sometimes millions of people. I must be responsible for and careful with my words. I plan to use on the ham bands the same communication ethics and practices I have used as a professional broadcaster.

Unless I and those around me who are interested in the new license are a fluke, most of the first wave of no-code Techs will be those who have always had a legitimate interest in the hobby, but who were put off by the code requirement. Many of us are already professionals in communications and electronics. The best way to guarantee no trash comes into the hobby is to not construct barriers at the entrance, but rather to guide those who come to the door. Give us a chance and teach us your ways.

Code does not a great radio operator make. Thanks to the FCC for giving me an opportunity to get into the hobby. I'll see you soon on 6 meters and above... hopefully in a year, I'll see you on HF as a General, then as an Advanced... but not with CW.

Say, if the code requirement were eliminated for all license classes, perhaps we could have a super-duper theory test (like 100 fill-in-the blank and essay questions—and no book with the answers in it, either!), and on-the-air evaluation of proper operating practices!... Linda KA1UKM

Jason Kelly NO0CALL yet, Fort Dodge IA It has finally happened! No code. I have been monitoring radio communications for over three years. From the beginning, my main interest has been VHF. I never did understand why a bunch of old men insisted that I learn the code when it is all but nonexistent in the bands above 30 MHz. I have passed the written portion of the Novice test, but have failed the code test three times! It drives me crazy. It is hard for me to waste time learning the code only to forget it after passing the test.

Many hams feel that the no-code Tech should not be allowed access to the 2 meter band. Why? They contend that the band is too crowded, and that there isn't room for "glorified CB operators."

Here in Iowa, I can monitor 20 repeaters all day without my scanner stopping more than three times! When it does, it's usually just some old man kerchunking to see if the unexercised repeater can still hear his handi-talkie that hasn't been charged in five years. Why should I become a ham? There are so few people willing to talk to some new kid under the age of 50. It has been many times that hams driving through the area check in on the local repeater only to be ignored because the old men don't know who they are.

Everything I have learned about amateur radio has been from *73* or Ron KF0LR. Ron deserves a medal of honor from hams trying to promote the hobby. He talks to anyone who might be interested in ham radio. If it weren't for KF0LR, ham radio would be dead in this community. Ron is why I would become a ham. He needs help promoting this great hobby. He cannot possibly elmer everybody that is interested!

Why doesn't the ARRL want new hams in the hobby to have access to the 2 meter band? They certainly aren't using it! If they don't, it will be taken away. Give it to the no-coders; we'll use it to promote ham radio and get more people to join the hobby and make it great again! I'm ready for my test. See you on the repeaters!

Frank Muratore KB2EZV, Copiague NY I would like to comment on an article, "Behold the Back Packet," in the December 1990 issue. Construction could have been simplified by using an electric knife to cut the foam. I have been using this technique for quite some time, and find that the foam cuts like butter.

Adam Harrod, Montpelier VT I am an SW listener, and have been for the past 10 years. As I am not a ham, I cannot transmit to receive any QSL cards. Is there any way to receive them?

Have cards made up for yourself with "SWL" printed on them instead of a callsign. Send your cards out to stations you hear, and you can send them a signal report. Request a QSL card in exchange.... Joyce Sawtelle

Stephen Barnett, San Carlos CA Your editorials remind me of a book published about a man in the village of La Mancha. His name was Don Quixote, and if I remember the story right, he liked to joust with windmills. Mr. Green, your windmill seems to be the ARRL. I keep reading your column with much interest. I am studying to become a Novice, and the more I can learn about what is happening in the hobby, the better I'll be able to operate on the air.

I have many questions. What good will the ARRL be to me when I get a license? How will the ARRL help me if I make an FCC error? Will the ARRL represent me in local, state, and federal government? How good are the ARRL publications? What about a magazine geared to the beginner in ham radio?

What can we do to advance, enhance, and expand amateur radio? Many people have lost life's challenge. You see school children "hanging out," young adults in cocktail bars, others sitting in front of the TV.

While SWLing on 10 meters, I heard a man in the San Jose area, who regularly sets up a ham station at the Children's Museum and lets the children become third-party operators. Listening to the hams talking to the children was quite interesting. This ham is doing a lot on his own time to further ham radio. The hams he contacted were also doing ham radio a good turn.

Enclosed is my subscription. I look forward to my first issue of your magazine so I can keep up with the man and his windmill. The local ham store is sometimes sold out of *73*, and now I will not miss out. Your ideas are up front and needed, the wheel that squeaks gets the grease.

The magazine you're looking for is being started—Radio Fun. The premier issue will be out in time for Dayton. It'll have simple theory, simple construction projects, kit reviews, easy explanations on how to get started. Subscriptions are $10/year.

Now, the ARRL. I can't think of any good the ARRL will do you other than let you read QST. *The ARRL won't help you with the FCC. They represent their own interests, not necessarily yours.* QST *is worth getting as a reference, but it's not for newcomers.*

Amateur radio can help kids enter a whole new world—technology. It can offer them fun, a whole array of exciting careers, and a way to cope with the teen years. But we need to make this world available to the kids through school radio clubs.... Wayne

Ocran M. Carr K9RGV, Racine WI I am a long-time subscriber to *73*. In one of your editorials, you asked the readers what they suggest you do to get their friends to subscribe to *73*.

I suggest you devote one page each month to some deserving black amateur radio operator. As publicist for the Omik Amateur Electronic Communications Association, I can tell you that 10% of today's hams are black, and we have never received the recognition that we deserve. Some examples: Mr. Everett Refroe W9HG, electronics instructor during WWI; Mr. James Cheeks W6TXW, an aviator who trained pilots for the Ethiopian Air Force, and introduced amateur radio to that nation in 1943; Mr. Robert F. Scott W2PWG, technical editor for *Radio Electronics Magazine* for 30 years; Mr. Jack Chancellor W9SON, a physicist at Fernion Lab. And the many black doctors who are hams even surprises me.

I can supply you with photos and information each month that will prove to be interesting and informative. I can guarantee you that our members will subscribe to *73* if they think there is something in it about our organization, and white hams will buy the magazine because they didn't know there were any black hams, and to see what they are up to, hi.

Yep, I'd be interested in some articles on black hams who've contributed to the hobby. But I suspect your estimate of there being 50,000 black hams is wildly optimistic.

While it appears to me that blacks are much more disintegrated than they were a few years ago, and generally tend to go to much greater lengths now to avoid contact with whites, that doesn't explain the almost total vacuum at Dayton and at every other hamfest I've attended in the last 50 years.

Ocran, I've met far more gay hams than black! And the same situation held when I was involved deeply in computers—almost no blacks. I meet many in the music business, but mostly as performers, not as businessmen. This has nothing to do with prejudice or bias; this has been my experience. It's the same for women—few in either radio or computers. Now how can this be explained? What's your take?

... Wayne

THE TEAM

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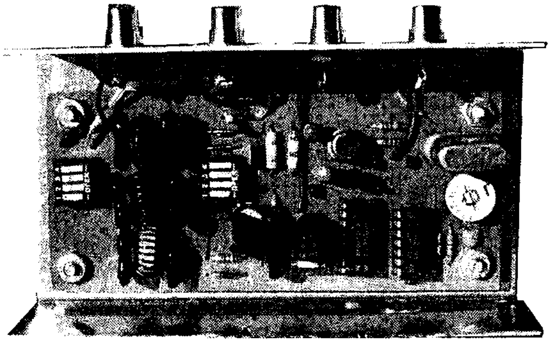

Three-band QRP with one crystal. . . see page 10.

Cover by Alice Scofield. Stamp photos by Raymond Schuessler.

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Audit Bureau of Circulations (ABC) membership applied for.
Contract: By reading this fine print you have become legally bound to get out of your rut and try something new. Do you spend all your time on SSB? Break out the old straight key and have a few QSOs in the Novice CW bands. Stuck on 2m repeaters? Try 6 meters. . . or microwaves. Does your station consist of $8,000 worth of store-bought gear? Pick up a $30 QRP kit, string together a $2 dipole, and go find a hilltop to operate from. Do something different!

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Technology Fugits

On the off chance that your finger on the mike button may be tired for a moment, let's leave your total devotion to the survival at any cost of our hobby of antique technologies and take a short trip into the present.

Are you prepared to get up in front of your local ham club and explain exactly how DSP works? That's Digital Signal Processing, old chap. It's one of those newfangled Japanese developments with which they're whipsawing what shreds we have left of our old consumer electronics industry.

Yamaha came out with the first practical DSP unit two years ago, followed a year later by Sony. I think I wrote about the Yamaha system at the time, in case your memory is still intact. It's a clever invention and will, I expect, get very popular for home entertainment systems. No, it doesn't have a lot of application in amateur radio. But some other new developments have! I'll get to those.

As an electronics "expert," a little facade we practice on our friends and family, we really should have at least a vague understanding of modern technology.

Okay, DSP. What they do here is to shoot off a gun in a series of different types of concert halls and rooms. They record the resulting echoes. Then they set about digitally copying the echoes and phasing which makes each hall sound different. The computer replication of each hall is then programmed into chips. Thus, you can play a CD and make it sound exactly as if it is being performed in a small supper club, in Carnegie Hall, Westminster Abbey, Avery Fisher Hall, etc.

The only hitch in the wagon here is that the original CD sound should be recorded in an anechoic room instead of a normal recording studio. Anechoic means without any reverberations at all. A totally silent room. These are not easy to build and are a real corker to use. They're generally used for loudspeaker development and other scientific applications.

Adding DSP to normal recordings may enhance their sound to some ears, but the result won't be a Boston Symphony Hall sound. Alas, as far as I know there aren't any anechoic recording studios yet. Well, there will be soon since we're building one. To make it possible for the performers to hear what they're playing we're feeding the sound back to them, complete with DSP ambiance. Far's I know we'll have the first DSP-ready CDs on the market in a couple months.

We're in the throes of finishing this new recording studio in time for Scott Kirby to lay down tracks for a third Scott Joplin ragtime CD.

How'd all that happen? Well, I've had it in my mind (no comments) ever since digital audio got started that there would be a growing need for digitally ready state-of-the-art recording studios. I decided to try and not be five years ahead of my time on this, so I've been hanging back.

Kirby did his first recording in the Peterborough Unitarian Church. The sound was pretty good, but the Steinway Grand was crummy and the recording sessions had to be done in the wee hours to avoid the noise of trucks driving down Main Street. That was a downer.

The second CD was recorded in the garage at my farm in Hancock using a couple of 1890s upright grand pianos that Knud Keller KV4GG (now KC1QP) found for us. We jury-rigged some wooden panels to give the garage a nice bright sound. Indeed the CD got a 10/10 rating...as high as it gets. It's been selling like hot cakes too.

A few months ago one of my magazine circulation people, Phil Martus, wanted some spare time work so I set him to straightening out my barn. He did such a good job he ended up with the whole center section empty. Hey, what a great spot for a studio! By luck Phil had lots of building experience, so he volunteered to take on the construction job.

Our recording engineer, Dave Torrey, designed the studios and Phil, with some help from friends, did the construction...all in a few weeks. A studio is enormously complicated. The walls have to be double and isolated from each other. Even the control room has to be isolated, with double windows. Bass-traps have to be built into the ceiling and walls. The heating, air conditioning and humidity control systems have to be totally silent.

One studio is normal and a second has sound absorbent walls, ceiling and floor, so it'll be the first recording studio in the country capable of turning out digital signal processing (DSP) ready recordings.

DCC

That stands for Digital Compact Cassette. Philips (Holland) and Tandy (Ft. Worth) are working on a new approach to digital tape. DAT, digital audio tape, requires a new format which is just like a miniature video cassette. DCC uses a cassette which is the same shape as our regular audio cassettes. With a DCC system we'll be able to play both DCC and audio cassettes with the same player.

Which brings up the question of how, without a high speed rotating recording head, can they get all that digital information on that eentsy tape? Well, what they've done is to find ways to cut down on the amount of information required to make our ears think they are hearing digital quality sound. Even though they've cut the amount of information down to about 25% of what's recorded on a DAT system, it still sounds good. I've listened to it.

If we have any technically inclined hams left they might be encouraged to see what they can do about digitizing the really low quality sound we require to talk all day saying nothing (with a few exceptions). Then they can start to work with every data compacting system they can find to improve the throughput.

Hmmm, you know, if we were to first send out an algorithm which makes it possible for a receiver to imitate our individual voice, then all we'd have to do is get the words we're speaking through as compactly as possible and reconstruct our voices with the algorithm. Follow me? Well, it was just a thought.

Every time I get together with engineers I'm amazed at how much progress is being made in data compacting. There are some new systems that were being discussed at the Consumer Electronic Show in Las Vegas in January that are able to cut the data by 1:77 and still not lose anything! They're using some of these approaches to get the bandwidth of HDTV down.

Of course I joke about our being able to get the bandwidth of ham transmissions down to under 1 Hz. Sort of joke, that is. If you've listened in to much ham gabble you know that the amount of data throughput is minimal. Call, name, town, signal report and...? Once those have been said a few times many ops seem to run dry. My suggestion is that we send our call and then a dot which will tell the other op that our name and town are in the *Callbook*, so look it up. The report is 5-9 (what else is there?). Please QSL. 73. Two dots coming back says roger on your name and town in the *Callbook*; roger on the 5-9, you're the same; roger on the QSL; 73. Save a lot of time and hassle.

If you find good information resources for amateur radio associated new technologies, whether magazines, books or newsletters, let me know so I can pass the word along. And if you come up with some ham applications, please consider *73* as a place to get published.

Okay, Experimenters!

There are some new chips which should have you busy breadboarding in short order. They are somewhat expensive, right out of the chute, but I expect we'll see prices declining as production ramps up. Now stop fussing, I'll tell you what it's all about. They're called analog storage chips.

If you have to ask me what to do with an analog storage chip, I know you're asleep at the switch. The whole idea should have had you jumping out of your chair with excitement.

What can you do with 'em? Well, how about building a semi-intelligent QSO machine? Each chip will hold up to 20 seconds of voice, so you're going to need a few. Let's say you rig up the first one so that when you make a contact you speak the other chap's call into a chip. You might store his name in a second chip. Are you getting it yet?

When it's your turn to transmit you turn on your rig and the first chip gives his call. Your QSO machine automatically switches to a series of chips which give your call, your name, signal report (5-9, of course!), and all the stuff you always say during your first transmission. The chip with his name recorded on it clicks in whenever your QSO chip flags it. This personalizes the contact.

A perfectionist might use a separate chip to store the signal reports and just push a button to indicate which report will be given.

All it'll take are three or four chips to hold your normal QSO information, the stuff you've been repeating over and over for years with little variation. You can even free yourself of having to record the other chap's name 90% of the time by having a dedicated name chip with 20 seconds worth of names on it. You just push the button for the name and it'll switch it in for you.

How does all this work? It's simple, the chip samples the voice message 6,400 times per second, digitizing it. This gives you a 2.7 kHz passband, which is fine for most hamming. They have a 3.4 kHz passband chip if you don't mind spending a little more per chip and only getting 16 seconds of voice. Being thrifty (cheap), I know you'll go for the 2.7. Hi-fi fanatics may

Continued on page 73

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

STS-37 Success!

Some exciting amateur radio firsts were achieved during the lastest flight of the space shuttle *Atlantis*. Astronaut Ken Cameron KB5AWP reported seeing good video from KC6A in Los Angeles, WA4NZD at the Marshall Space Flight Center, N9AB in the Chicago area (the farthest north contact), and WA3NAN at the Goddard Space Flight Center (linking via the 40-foot dish at the U.S. Naval Academy, shown in the May "QRX"). In addition, Andy N9AB sent up a video tape of the STS-37 launch. This is the first time live television has been uplinked to any U.S. spacecraft, and the first time a shuttle crew could watch their own launch while still in space.

It is uncertain at this writing whether the other two uplink sites were successful. KE4PT at the Motorola club in Florida, and the Johnson Space Center radio club (W5RRR), made several attempts, which may be on the second video tape recorded on board the orbiter.

In another first, a brief contact was completed between Ken Cameron KB5AWP on board the *Atlantis* and Musa Manarov U2MIR on the Soviet space station *Mir*. Musa later confirmed the contact via a message on his orbiting packet BBS. On the tape recorded on the shuttle, Musa could be heard clearly.

A number of school contacts were established via a telephone bridge during several of the passes. Each of the all-ham crew answered questions from members of the selected schools.

A problem occurred in the audio path of the SAREX module which prevented any packet contacts or SSTV uplinking. However, at least a few SSTV downlinks were successful.

Watch for the complete STS-37 story in the July issue of *73*. *Thanks to Lou McFadin W5DID, Andy Bachler N9AB and Dick Christiansen KK4HF for the above info.*

Photo A. Members of the Marshall Amateur Radio Club pose in front of antennas for sending ATV to Atlantis. *Left to right: Terry Jones NZ8C, Randy Galloway KN4QS, Gene Marcus W3PM, Don Heidiger N4MSN, Larry Savage WA4CAX, Ed Stluka W4QAU, Tim Cunningham N8DEU.*

Amateur Radio Talk Show on Satellite TV

"QSO Amateur Radio," a weekly TV show hosted by Jack Smith WA2QYT, has been active over the past few months to an ever increasing audience. The video portion of the show airs every Monday night from 10 p.m. to midnight on Spacenet One, transponder 15 (S1-15). Plans are for a call-in talk show from 9 p.m. till midnight, Mondays through Fridays, on the same channel. The nightly talk shows will cover topics on amateur radio, specialty modes, shortwave listening, and satellite TV.

You don't need a satellite dish to tune in to the program. All amateur radio operators have permission from QSO Amateur Radio to retransmit the show over both audio and ATV repeaters. Also, every Tuesday night from 9 to 10 p.m., the ATV net on 3.871 MHz will actually be uplinked to the satellite. Check into the net and hear your signal via the satellite as well! Bill WB8ELK will host an ATV talk show after the net until 11 p.m.

The talk shows can be heard on the standard 6.8 MHz subcarrier, except Mondays between 10 p.m. and midnight when the talk show will operate on the 6.2 MHz subcarrier (concurrent with the video show).

For more information, contact Jim Bass at (315) 673-3752.

Photo B. Moody T. Law WO6I, the 22nd president of OMIK, will serve the 39-year-old organization for the next two years.

Videos Needed

Tapes of the recent SAREX hams-in-space mission are needed to produce a new educational video. Specifically sought is footage of youngsters in schools making contact with the all-ham crew on the shuttle. It may be in Betacam, 3/4" U-Matic, M-II or 1" Type C. Also acceptable are tapes on the Super VHS (S-VHS) and Hi-8 home video formats. NOT wanted are standard 8, VHS or VHS-HQ, Betamax, or home movie film. Producers Roy Neal K6DUE and Bill Pasternak WA6ITF will use as many shots as possible in the finished video, due out in late summer or early fall. Include a self-addressed, stamped mailer, if you want your video back. Send all videotapes to SAREX '91 VIDEO, %Bill Pasternak WA6ITF, 28197 Robin Ave., Saugus CA 91350. *TNX Westradio.*

Power Audit Results

As a result of "power audits" of 209 amateur radio stations last winter, the FCC has come to three conclusions. First, that most amateurs are not operating at minimum power as required by Rule 97.313(a). Second, that reduced power can alleviate significant reception interference problems in consumer electronics gear without serious degradation to communication capabilities. And third, that in addition to lowering output power, installing filters at either the transmitter or receiver might be required to eliminate interference.

FCC Field Operations Bureau Chief Richard Smith said that 75% of the stations surveyed experienced no degradation when their output power was reduced by more than 50 percent. However, even running low power cannot solve interference problems in many cases.

The study is being forwarded to

QRX . . .

Photo C. The parents and students of the Springfield Estates Ham Club. Luke is in the center.

the Private Radio Bureau for evaluation. It would be the purview of the PRB to make any recommendation to the Commissioners for regulatory action. *TNX* Westlink Report.

OMIK's WQ6I

The nation's largest black amateur radio organization, OMIK Electronic Communication Association, elected a new slate of officials this year at a convention held in Atlanta, Georgia. Elected for president was Mr. Moody T. Law WQ6I of Claremont, California, to head OMIK for the next two years. Mr. Law, the twenty-second president of OMIK, majored in biology at the Spring Hill College in Mobile and also in Nashville at the Tennessee A&I University. He completed graduate work in business administration at Laverne University in Laverne, California. For the past 19 years he has worked with Schering Labs, training and supervising pharmaceutical service representatives. He is past president of the Los Angeles Amateur Radio Club and is committed to the challenges encountered by OMIK.

The name "OMIK" originated from the first letters of the states of Ohio, Michigan, Indiana, and Kentucky, where the first members of the organization lived. OMIK had its beginnings on the campus of Wilberforce State College in Wilberforce, Ohio, in the early '50s. The original group of 11 black members has grown to several thousand, with members located in 42 states and several other countries. A sizable number of YLs and XYLs have been associated with the group since its inception, and they have been invaluable to its success over the years.

OMIK's fundamental purpose is to promote fellowship among those interested in the advancement of amateur radio. This includes electronics, technology, public service, and the promotion of international good will. OMIK also serves as the national organization for a network of local amateur radio clubs. Any licensed amateur radio operator who supports the ideals of the association may join OMIK.

OMIK membership enjoys a diverse range of professional, skilled, and retired people—all brought together by their common interest in and enjoyment of amateur radio. *TNX Ocran Martin Carr K9RGV.*

Luke Ward KC4UJS

Every Friday evening at the Springfield Estates Elementary School in Springfield, Virginia, eight-year-old General Class Luke Ward KC4UJS and his father, Keith Ward KC4TZJ, teach amateur radio to a group of 17 students and 15 parents. Studying together makes learning fun and easy for everyone. Parents and children are members of the Springhill Estates Ham Club, the second ham club started this year by volunteers of the Mt. Vernon ARC. Luke Ward KC4UJS is in the front center row in the photo, wearing his blue Mt. Vernon ARC shirt.

KC4UJS sometimes writes for "The Bacon Bits," a newsletter for young hams and hams-to-be in kindergarten through eighth grade. It is published by the Marlborough Communications Club and the Marlborough Desktop Publishing Class in Kansas City, Missouri. *TNX David Cowhig WA1LBP.*

Ham Arrested

Last April, amateur radio operator James A. Haas of Athens, Ohio, was arrested by federal authorities for making false distress calls. At a hearing, he was released on $100,000 personal recognizance bond. If convicted, Haas could get five years in prison and be fined $250,000.

Haas is suspected of making dozens of fake distress calls in Athens, Cincinnati, and Columbus, Ohio, and also in Kenton County, Kentucky. Many of the calls resulted in massive searches by police agencies. One call resulted in a 10-hour search involving 15 police agencies and helicopters.

FBI spokesman Ed Bolt said the calls also included tones and noise broadcast over police frequencies, interfering with legitimate police transmissions, and some "harassing and obscene statements" over the Kentucky State Police frequency.

Haas was located by the FCC, FBI, and Prince William (Virginia) police using sophisticated radio direction finding equipment. A cassette marked "siren" with a variety of sounds of police sirens, was found in the van with Haas. Haas was in the Washington, D.C. area to attend an amateur radio convention.

The 39-year-old ham is adviser to the ham radio club at the high school where he teaches physical education. *TNX David B. Emmons for the* Washington Post *clipping and* Westradio *for the AP material.*

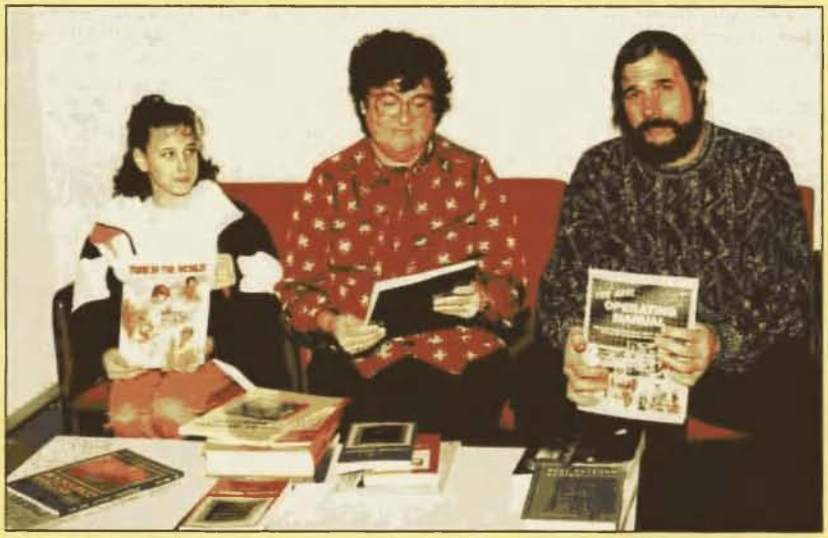


Photo D. Eleven-year-old Tiffany Karabin KA3YHF, Head Librarian Caroline Gillis, and Mike Karabin N3GJT, look over the books donated to the library by the Warminster Amateur Radio Club.

Three Bands with One Rock

Versatile QRP transmitter for 80, 40 and 20m.

by Mike Gasperi WW9X

When building simple QRP rigs, the most expensive and difficult part to find is the crystal, or rock. Usually they have to be specially ordered, and delivery may be slow. The transmitter design in this article allows the same crystal to serve multiple bands, which makes for flexible and economic operation.

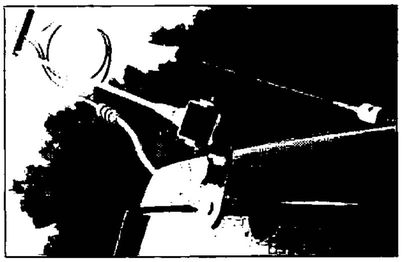


Photo. A peek inside at the finished circuit.

The Circuit

The circuit consists of seven basic elements: the oscillator, divider, keying circuit, amplifier, receiver limiter, filters, and power supply. It's designed to operate from 12 VDC, with about 1 watt output on all three bands. Operation is simple. The desired frequency is selected for amplification, and the appropriate low pass output filter switched in line with the antenna. Forty meter band crystals can also be used in the oscillator, with division by two to get frequencies in the 80 meter band. Or you can use 80 meter band crystals with no division.

The transmitter block diagram is shown in Figure 1. Central to its operation is the fact that the amateur bands are harmonically related. Twenty meters is twice the frequency of 40 meters, and twice again that of 80. Normally, frequencies are synthesized upward, starting with a low one and doubling or tripling it to the desired higher frequency. However, digital logic chips easily divide high frequencies to low, and this is how I used one 20 meter band crystal to operate on 40 and 80 meters as well.

The Oscillator

The variable crystal oscillator is made from two TTL inverters in U1. Gates from the high power CMOS (HC) family should be used since they have much better logic levels and thresholds (nearly zero to Vcc) than other TTL families, such as LS. Vcc. Resistors R1 and R2 bias the gates into linear operation while variable capacitor C1 is used to shift the crystal frequency. The other inverters are used to buffer the oscillator and shape up the waveform.

Crystal X1 is a plated, AT-cut fundamental crystal in a HC-6/U holder. However, this oscillator design is very tolerant, and works with most microprocessor, color burst, and other surplus crystals. For three-band operation, the crystal must be cut for the 20 meter band. I use 14.060 MHz since it is the standard QRP for 20 meters. Divided by two, it gives 7.030 MHz, which is near the 7.040 MHz, 40 meter QRP frequency. Dividing by four gives 3.515 MHz for 80 meters, which is fine if you have an Extra class license.

You could also cut the crystal for the 14.11 to 14.15 MHz subband; this would make the divided frequencies near 7.060 and 3.530 MHz usable with a General class license. Unfortunately, not a lot of CW goes on that far up the 20m band, since other countries can broadcast single sideband there.

The Divider

U2 is a 4-bit binary divider that creates frequencies harmonically lower than the oscillator. Usually, only division by two or four are of any use for amateur operation, but connection to eight is provided just in case. The HC logic family should be used for U2 for reasons already mentioned. A 74HC163 can be substituted for the 74HC161 since the clear function is not utilized. All unused inputs to the chip must be tied appropriately high or low for reliable operation.

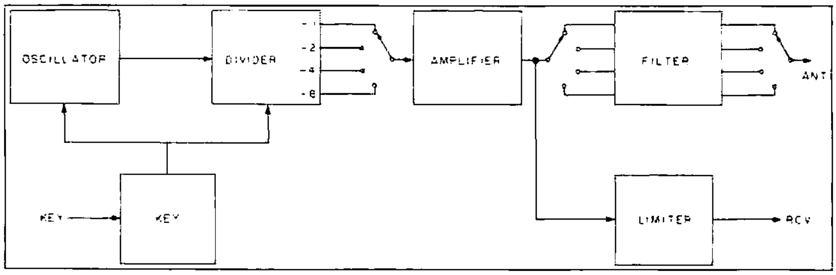


Figure 1. Circuit block diagram.

Keying

Keying is accomplished by powering U1 and U2 through transistor Q1. Voltage regulator U3 is used to create the five-volt power needed for the TTL gates. Wave-shaping is controlled by C5, C6, and R3. The values given create a crisp wave shape without noticeable clicks or chirps. If a keyer is used, it should be set for positive keying.

Amplifier

The selected frequency is first amplified in current by the emitter follower Q2. It then passes to the Class C output amplifier transistor Q3 via C8. Resistor R6 guarantees that Q3 is off during key-up, while diode D1 keeps the base voltage from going too negative. Transistor Q3 is a 2N2219A, which is just able to handle the 1 watt output power. It is inexpensive and easy to find. You should definitely heat-sink it.

Harmonic Filters

Depending on the selected frequency, an appropriate filter must be used to reduce harmonic content. Basically, the waveforms are square up to this point, and rich with odd harmonics. The three filters given are pi-configuration low pass, with 14, 7, and 3.5 MHz cutoffs. An option of bypassing the filters is given with S2 and S3, so that off-board filters can be used or circuits debugged. Changing frequency bands requires setting both switches, S2 and S3, so that only the desired filter is connected.

Limiter

Full break-in QSK operation is achieved by picking off the antenna signal with C11. During transmit, the RF is limited by a pair of diodes, D2 and D3. Although this only limits the signal to about 1 Vpp, it's sufficient to prevent damage to receivers. There is quite a bit of signal loss with this technique. An external transmit-receive TR switch is another good alternative.

Power Supply

Capacitors C4 and C9 filter the input voltage to the transmitter. The 5-volt power for U1 and U2 is created by U3, a TO-5 package voltage regulator. C2 and C3 are bypass capacitors located at each digital integrated circuit. Radio frequency choke L1 and

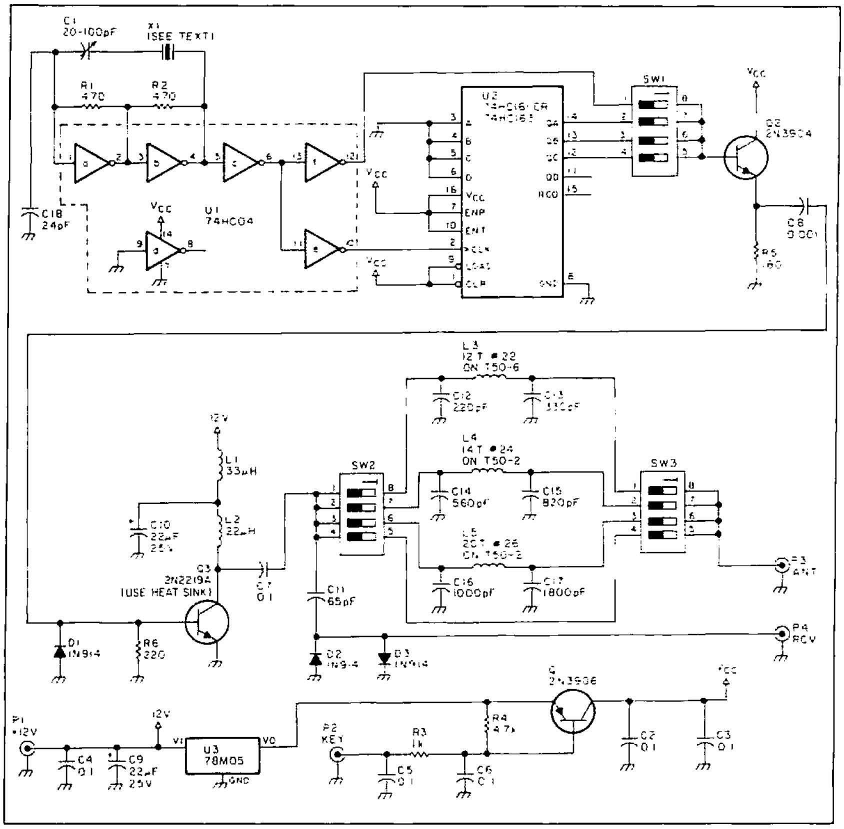


Figure 2. Schematic diagram.

capacitor C10 keep the 12 volt power to the final transistor clean and solid.

Construction Notes

A circuit board etching pattern is illustrated in Figure 3, and a component layout for the pattern is shown in Figure 4. Other construction techniques should also work. The digital integrated circuits need solid grounds and proper bypass capacitors. Toroidal inductors L3, L4, and L5 should be wound spreading the turns over about two-thirds of the circumference. Leads should be kept as short as possible on all components. The DIP switches need to be easily accessible when you're switching bands, so don't bury them in a deep enclosure. Variable capacitor C1 also needs to be available to fine-tune the operating frequency. Simple RCA jacks can serve for all four external connections; just make sure they are properly labeled to prevent accidental damage.

Performance

The prototype transmitter output power to a 50 ohm load with 12 volts input power was 0.8 watts on 20 meters, and 1.2 watts for 40 and 80 meters. Power supply input current was measured at 250 mA for an input power of 3.0 watts. This gives about 40% total efficiency for the entire transmitter. Harmonics were 30 dB down, and no key click or chirp was observed. Operation on as little as 6 volts

Continued on page 42

Parts List

C1	20–100 pF, mica trimmer
C2–7	0.1 μF, monolithic
C8	0.001 μF, disk ceramic
C9,10	22 μF 25V, electrolytic or tantalum
C11	65 pF, disk ceramic
C12	220 pF, silver-mica or polystyrene
C13	330 pF, silver-mica or polystyrene
C14	560 pF, silver-mica or polystyrene
C15	820 pF, silver-mica or polystyrene
C16	1000 pF, silver-mica or polystyrene
C17	1800 pF, silver-mica or polystyrene
C18	24 pF, disk ceramic
R1,2	470 ohms, 1/4 watt
R3	1k, 1/4 watt
R4	4.7k, 1/4 watt
R5	180 ohms, 1/4 watt
R6	220 ohms, 1/4 watt
D1–3	1N914
S1–3	DIP switches, 4-position
Q1	2N3906
Q2	2N3904
Q3	2N2219A, with heat sink
L1	33 μH, RFC
L2	22 μH, RFC
L3	12 turns #22 enamel, on T50-6
L4	14 turns #24, on T50-2
L5	20 turns #26, on T50-2
U1	74HC04
U2	74HC161, or 74HC163
U3	78M05 5V regulator, TO-5 package
X1	fundamental mode, with socket (See text.)
P1–4	RCA jacks

Suitable enclosure with mounting hardware.
A blank PC board is available for $4.50 & $1.50 postage/handling per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

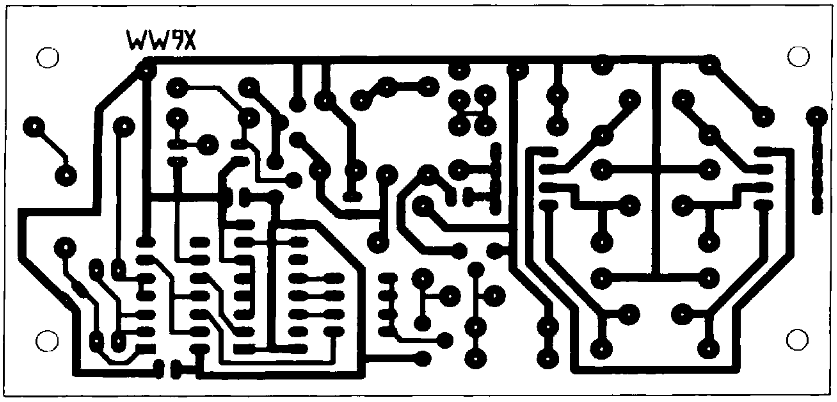


Figure 3. Printed circuit pattern for foil side.

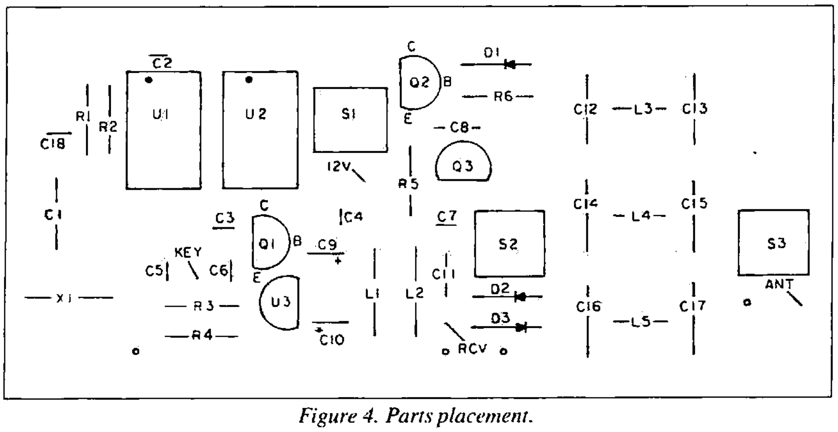


Figure 4. Parts placement.

73 Review

by Bill Brown WB8ELK

Get-Tech
George Tarnovsky KE2AM
201 RD2 Riley Rd.
New Windsor NY 12550
(914) 564–5347
Price Class: $69, $85 with battery-backed socket

The KE2AM Voice ID and Repeater Controller

Control your repeater economically!

How would you like a repeater controller/ ID that actually identifies in your own voice? George Tarnovsky KE2AM of Get-Tech has designed just such an animal. His controller provides you with the basic timing signals to put together a very economical repeater system. It even provides you with the capability of identifying in your own voice with the onboard digital voice recorder.

The Voice Recorder/IDer

The KE2AM controller is offered completely assembled for the amazingly low price of $69. All parts are mounted on a high quality 3.75" x 3.375" circuit board.

The voice record section consists mainly of a surface-mounted control chip, along with a 256K memory IC. A jumper chooses between 6 or 12 seconds of recorded message.

The unit is designed to take low-level audio from a microphone. I just hooked up my remote HT mike to the audio input terminals. To record your message, just flip the record/playback switch and press the momentary contact start button. When using other audio sources, you may want go through a potentiometer to drop the audio down to acceptable levels. The audio will sound clipped if you overdrive the recorder.

Now, just flip back to play, then hit the start button for an instant replay. You can choose two sampling rates via a jumper wire. In the 5 kHz rate, you get 12 seconds of message time, but you will notice some sampling distortion. For higher fidelity, use the 11 kHz rate, but you only get 6 seconds for your message. Even at the higher sampling rate, you'll notice something of a background hiss. Another jumper allows you to select a low-pass filter which eliminates most of this. Although low-level audio is all that is necessary for your repeater transmitter, the controller has an LM-386 audio amplifier which can drive a small speaker loud enough to hear in even the noisiest environments.

With the filter in place and at the higher sampling rate, I found the reproduction to be of excellent quality. Six seconds may not seem like a lot but it is more than sufficient for a repeater ID.

Repeater Controller

This board is not only a high quality voice recorder, it also supplies all of the timing signals necessary for repeater control. A connection to your receiver's squelch line is all that's needed to activate the transmit controller and timer logic. Your receiver's squelch circuit must be able to supply 3 to 12 volts when activated. In most rigs, it's possible to tap this off of the receive LED. When an open squelch signal is detected, the controller turns on an open collector transistor to key your repeater's transmitter. The transmitter enable signal is also controlled by the status of onboard timers.

Three separate timers, along with associated logic circuitry, comprise the controller section.

The **ID timer** makes sure that your repeater is identified every 7.5 minutes. It won't ID with each transmission. It will reset when first activated and identify with the next transmission after 7.5 minutes has elapsed.

The **time-out timer** keeps conversations from getting too long-winded. After two minutes of continuous transmission, it will drop out the transmitter until reset by the squelch line.

The **squelch tail timer** gives you 2.5 seconds of hang time when the repeater is dropped.

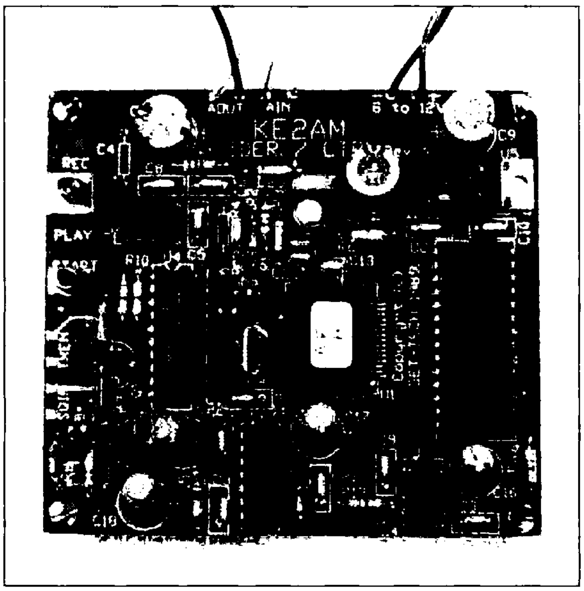
Impressions

I found the KE2AM controller to be a very convenient way to put together a basic repeater quickly and inexpensively. Using two HTs and this controller, I was able to put together a portable crossband repeater with relatively little fuss and bother. It's been great taking this to hamfests or up to mountaintops.

The controller requires 8–15 volts at 118 mA. The current drain may be a little on the high side, but most of it is due to the PAL logic array. The plus side is that the PAL circuit reduces the IC count considerably.

Since the RAM memory is erased when the power drops out, your voice message disappears. This could prove to be a major problem if your repeater site has a power glitch or outage. Fortunately, Get-Tech offers a battery-backed socket option that retains RAM memory when power to the controller is removed.

I highly recommend the KE2AM controller. It's a high quality unit that will leave enough money in your pocket to build the rest of your repeater.



The KE2AM voice recorder and repeater controller.

Tune in on Philately

Immortalized in stamps.

by Raymond Schuessler

All around the world, countries have honored amateur radio and ham radio operators on their postage stamps. Collecting these stamps can be a fun hobby for hams.

Postage stamps originated in England in 1840. From the beginning, postal authorities designed stamps to honor the great milestones in science, medicine, the arts, and history. The people and events so depicted have earned a permanent niche in world history—for stamps never perish. If archaeologists of the far future unearthed our civilization, they would have a good idea of our culture and history from our stamps.

Ham operators deserve the honor they have received in philately. When you hear stories of lives saved, you know these badges of honor are well-deserved. Stories I have heard include a New Orleans operator who heard an emergency call for snake serum in Columbia, and relayed the call; an operator who heard a call for help from a ship in the arctic that had struck an iceberg; and an operator in Canada who helped rescue four soldiers in Manitoba, 1,500 miles away.

The postage stamps honoring amateur radio commemorate the handful of pioneers in 1901 who, inspired by Marconi, the father of wireless communications, grew into an international fraternity.

In those days, all transmitting and receiving apparatus had to be assembled by hand, and there were few books and no magazines on the subject. Because of hams, many new inventions came into existence. For example, hams were the first to discover the value of shortwaves, which opened the way for TV and FM broadcasting. And it was a ham who helped track the first satellite.

The wartime stamps are well-taken, since World War II saw over 25,000 hams in uniform designing "commo" equipment, setting up global networks, and manning radar installations.

Israel honored its amateur radio operators in 1987. The Palestine Radio Club was organized during the British Mandate, and eventually became the Radio Amateur Association of Israel. These hams played an important role in laying the foundations of the Army Signal Corps, as well as the civilian communication network during the early years of the state of Israel. The association has 900 members, 700 of which hold official licenses.

Ascension Island issued a stamp in 1982 showing King George V making his first Christmas BBC radio broadcast to the empire.

A variety of old ham equipment is portrayed on some stamps. This adds to their collectibility. Even Disney's Chip and Dale get into the act on the Bhutan stamp shown.

Your Own Collection

If you want to start your own stamp collection, consult a stamp catalog (such as Scott's, Gibbons, or Minkusi in your local library. It lists or illustrates all stamps and their official call number and current value. The catalog is revised annually to include all new stamps and price changes.

Subscribe to a good weekly stamp newspaper (such as *Linn's*), which you can also look over at most libraries. Search their ads for dealers who specialize in the nations whose stamps you need. You can mail-order stamps, too.

You can also subscribe to a "new issue" postal service. The service will send you all the new ham issues as soon as they are released.

Visit a local stamp shop. They may have a good selection. You may be able to fill out some blank spaces in your collection. Used stamps are cheaper than new, mint stamps.

Stamps should be stored in three-ring plastic sheets with windows to protect the stamps from creasing, humidity, and dust. These sheets can be kept in a loose-leaf notebook.

Accidental Benefits

The greatest monetary profits lie in printing errors. Once a man in London bought a sheet of 100 nine-cent stamps. When he got home, he found that no price had been printed on them. A stamp shop bought the sheet for $60,000.

Another example: In 1918, the U.S. airmail stamp of the Jenny plane was printed upside down. Today, one of those stamps sold at a recent auction for $148,000!

Some ham club bulletins carry columns dealing with philately, and others carry stamp news over the airways, as they do in Canada, Sweden, Cuba, Czechoslovakia, Berlin, East Germany, Bulgaria, Belgian, and Portugal.

As a ham, you'll have a special advantage. You'll be able to ask ham philatelists to send you ham stamps from their countries. You'd even be able to trade your duplicates worldwide.

Few hobbies are more rewarding and useful than ham radio, with its friends, fun, and excitement. An interest on the side in philately will add to the fun. Tune in and see.

You may reach Raymond Schuessler at P.O. Drawer 69, Lake Helen FL 32744-0069.

Stamps from all over the world, honoring amateur radio and hams.

A Pseudo CW Filter

Be good to your ears.

by Jim Melton WR5B

To my ear, most CW filters have a more or less "ringing" sound. Some operators can live with it, but to me it's very distracting.

The circuit presented here is not actually a filter; hence, the name Pseudo Filter. It completely eliminates the original CW signal and its normal background noise. At the same time, it uses the decoded signal to switch on and off the output of an 800 Hz oscillator. An added feature is that while tuning, it automatically zero beats with the received CW signal.

About the Circuit

The circuit is built around two 567 tone decoder ICs. Refer to Figure 1 for the 567 pinout. The 567 contains a PLL (phase-locked loop) with a center frequency that can be set with one external series resistor-capacitor combination (R1, C2) and (R4, C7) to any frequency between 0.01 Hz and 500 kHz.

The approximate center frequency can be determined using the formula $f = 1.1/RC$, where f is the center frequency of the internal oscillator. Capacitors (C3, C4) and (C5, C6) set the capture bandwidth of the 567 IC anywhere from zero to 14% of center frequency. The values shown in Figure 3, the schematic, set the bandwidth to the widest value, which

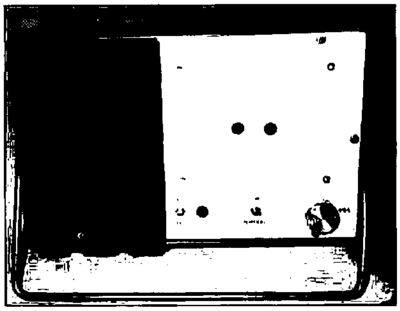


Photo. The Pseudo Filter installs easily in a speaker enclosure.

gives a "lock on" of a little over 100 Hz for an 800 Hz tone.

Since we're interested in an audio frequency, we take the input to the 567 directly from the speaker jack of the receiver. The 567 is designed so that pin 8 goes low when the input frequency is within the passband. Pin 8 is an active low output. This means it goes from near the positive supply voltage to ground through an internal open collector transistor switch when a tone is detected. When this happens, its associated LED will glow as long as the CW signal is present.

Set Up

Adjusting the two 567 center frequencies is much easier if you have access to an audio frequency generator and a frequency counter. Hook up the frequency counter to pin 5 or 6 of U1 and adjust for a center frequency of 775 Hz with R1, move your counter probe to pin 5 or 6 of U2 and set it to a center frequency of 825 Hz with R4. At these settings, the two frequencies should overlap approximately 50 Hz. If you don't have access to either of these instruments, try setting R1 to 13.33k ohms, and R4 to 14.19k ohms. On the two units I built, these values put me in the ball park. You might have a friend send you some code while you do a little "tweaking" of the two-variable resistors until you are satisfied with the operation of the unit.

Circuit Operation

In operation, audio from the receiver is connected through a 0.1 µF capacitor to the

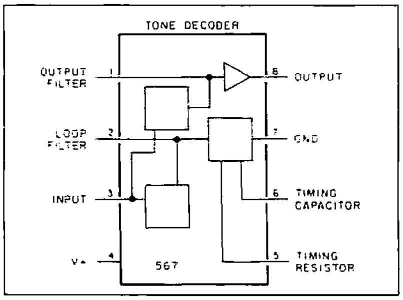


Figure 1. The 567 pinout.

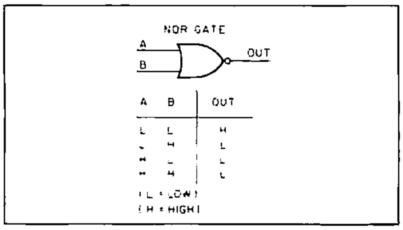


Figure 2. NOR gate truth table.

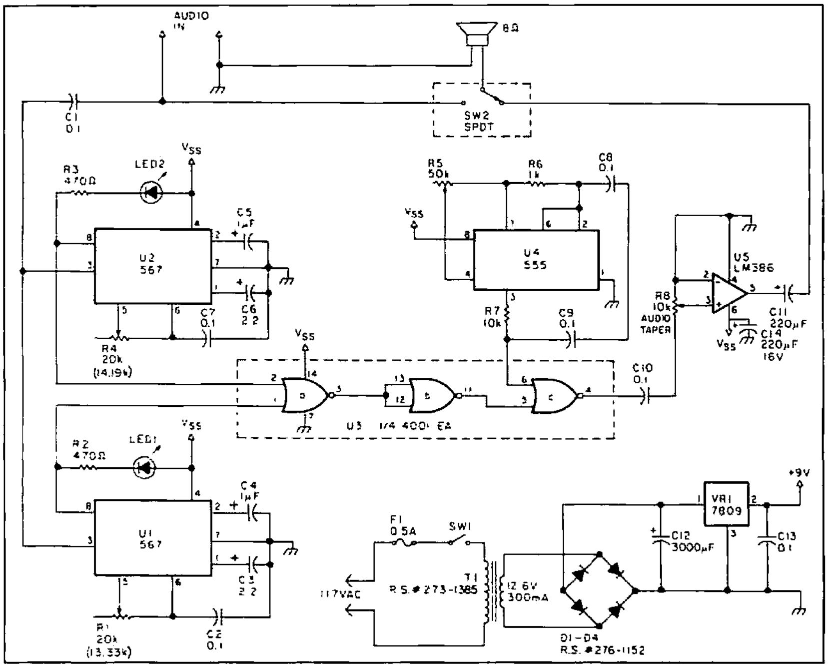


Figure 3. The schematic for the Pseudo Filter.

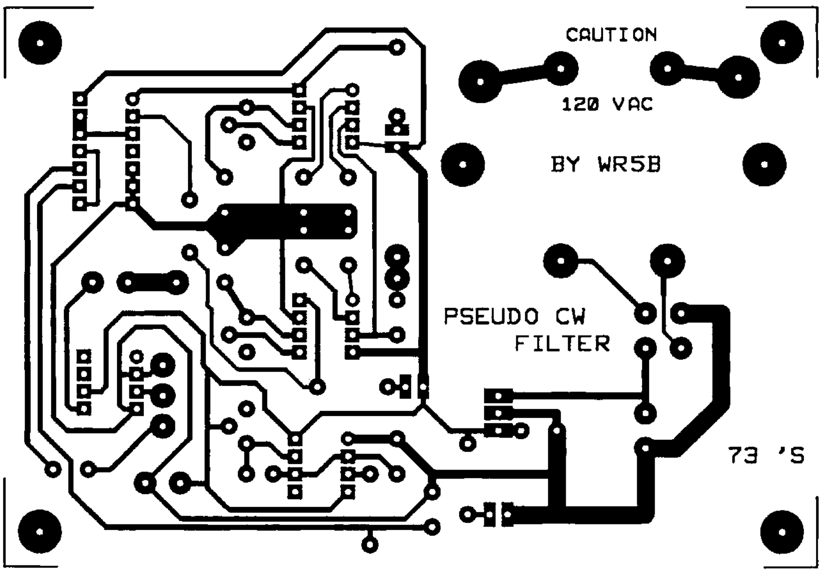


Figure 4. PC board foil pattern.

input (pin 3) of each 567 IC. When the received signal is approximately centered between the two 567 frequencies (775 and 825 Hz), pin 8 of both ICs will go low. These pins are connected to pins 1 and 2, respectively, of U3-a, which is 1/4 of a quad two-input NOR gate. Both inputs to this gate must go low for the output (pin 3) to go high. See the truth table for a NOR gate in Figure 2.

U3-b is connected to function as an inverter. An inverter is necessary because the 555 timer IC generates a continuous audio frequency, and without the inverter you would hear a steady tone interrupted only in unison with the received CW signal. Try copying code that way sometime!

The audio frequency generated by U4 is controlled by a PC mount trimmer, R5. Adjust R5 for either 800 Hz, or any tone pleasing to you. Pin 11 of U3-b is the output of the inverter. This point then goes to pin 5 of U3-c. Pin 6 of U3-c goes to pin 3 of U4, which is the output of the 555 timer, after some wave-shaping done by the RC combination of C9 and R7. In the case of U3-c, pin 5 will remain low for the exact duration of each DIT/DAH signal. The other input to this gate, pin 6, fluctuates between the high and low state 800 times per second as a result of the audio signal generated by the 555 timer IC.

Keep in mind that U3-c is being used as a digital switch. Therefore, instead of "keying" the audio oscillator on and off—its output, which is a continuous triangle wave, is simply switched in and out of the circuit 800 times per second as long as a decoded CW signal is present. Last, the output of U3-c (pin 4) is an 800 Hz square wave that is then amplified by U5, an LM386 audio amplifier.

One last thing about U3: All unused inputs of this chip should be tied to either the supply voltage or ground, so connect pins 8 and 9 to pin 7, and leave pin 10 open.

I used the 555 timer to generate the 800 Hz tone because that happened to be what I had on hand. Also keep in mind that the amplified square wave will sound just a tiny bit raspy. Admittedly, different ICs and an oscillator generating a pure sine wave could be used to follow the 567 decoders; however, as I stated, I chose the least expensive route and used the components I had on hand.

Don't be afraid to experiment. On that same subject, I also had a 7809 voltage regulator—hence the 9 volt power supply. A 5 volt supply would work just as well. But don't exceed 9 volts, as that is the maximum for the 567 IC. As you can see in the schematic, the power supply is just a standard, full-wave regulated supply.

Using the Filter

The SPST switch is wired so that you can switch the speaker between the audio as received from the receiver—standard operation—or audio only from the filter. Set the switch for standard operation, and as you slowly tune across a CW signal, either one or the other of the LEDs should start blinking in time with the received codes. Keep turning the dial slowly until the second LED starts blinking. At that point, switch to the filter audio, and the only sound you should hear is code—minus any hash or static. Also note that when both LEDs are blinking, you should be within approximately 25 Hz of zero beat. If you are answering a CQ, use only the tuning dial to zero in on the signal. If you are calling CQ, you will need to use the RIT control if your receiver is so equipped to fine-tune the answering call's frequency. Finally, there is nothing critical in wiring. If you choose not to go with a PC board (see Figure 4), you can use either wire wrap or perf board. ■

Pseudo Filter Parts List

R1,4	20k PC mount potentiometer
R2,3,9	470 ohm resistor
R5	50k PC mount potentiometer
R6	1k ohm resistor
R7	10k ohm resistor
R8	10k ohm panel mount audio taper potentiometer
C1,9	0.01 µF
C2,7,8,10,13	0.1 µF
C3,6	2.2 µF electrolytic or tantalum
C4,5	1.0 µF electrolytic or tantalum
C11,C14	220 µF/16V electrolytic
C12	3000 µF electrolytic (see below)
U1,2	567 tone decoder IC
U3	4001 quad two-input NOR gate
U4	555 timer IC
U5	LM386 audio amplifier
F1	fuse holder
SW1	SPST switch
SW2	SPDT switch
T1	117V to 12.6V; 300 mA transformer
D1–D4	full-wave rectifier module
VR1	7805, 7808 or 7809 voltage regulator IC
LEDs	red (3)
SPKR	8 ohms

It's OK to use three 1000 µF capacitors for C12. You may also use Radio Shack 273-1385 for T1, and Radio Shack 276-1152 for the rectifier module.

A blank PC board is available for $4 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

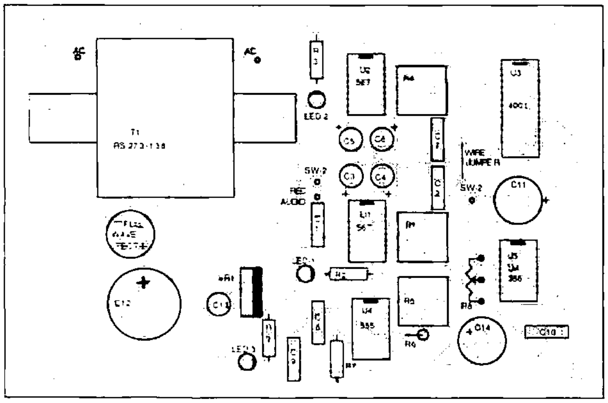


Figure 5. Parts placement.

Build the Brass Pounder's Keyer

A memory keyer that reproduces your true CW "fist."

by Dan Mc Cranie AA6GG

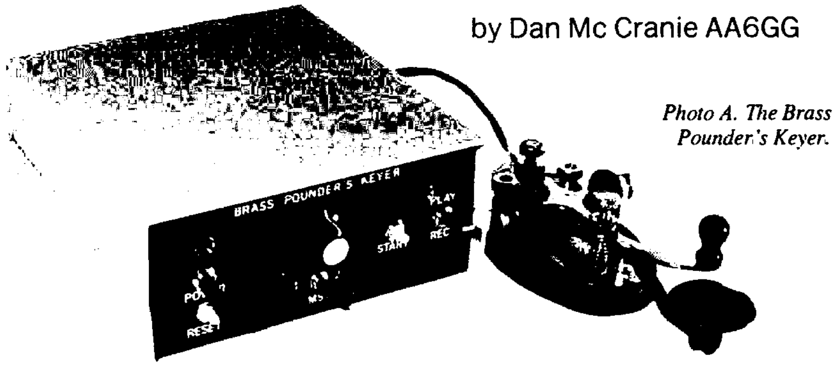


Photo A. The Brass Pounder's Keyer.

I've been in ham radio since I was 12, and I've always used a hand key for CW. My father was a chief radioman during WWII. When the family was back together after the war, he taught me the code and how to send on a hand key. There is a cadence and a distinct rhythm that you can detect when someone uses a hand key and, through the years in ham radio, I've really come to enjoy rag-chewing with other CW operators, and especially with the guys still using hand keys.

This project is a little specialized. I started it a while back with the intention of building a solid-state keyer that would accurately record the "fist" of the operator. I realized that, in doing this, I wouldn't be maximizing the storage efficiency of the semiconductor memories—but I didn't care. Memories are getting cheap enough to allow for some "programmed inefficiencies."

The Brass Pounder's Keyer is the result of this effort. In designing the controls for the keyer, I tried to make the machine as user friendly as possible. Control switches closely resemble that of a tape recorder (record, playback, start, etc.), and the machine can be left installed between your hand key and your rig without affecting normal (non-keyer) operation.

Theory of Operation

The Brass Pounder's Keyer is a digital recorder that will accurately reproduce the speed and cadence of the operator's keying. The heart of the circuit is a new type of semiconductor memory known as Electrically Erasable Programmable Read Only Memory, or EEPROM. Data is written into this memory in much the same fashion as conventional semiconductor memories. Unlike conventional memories, however, the EEPROM has the ability to retain previously stored information, even when power is removed. The EEPROM is guaranteed to hold this data for a minimum of 10 years. In addition, contents of the EEPROM data can be rewritten up to 10,000 times. By using this type of memory, power can be removed from the device at any time, and for any length of time.

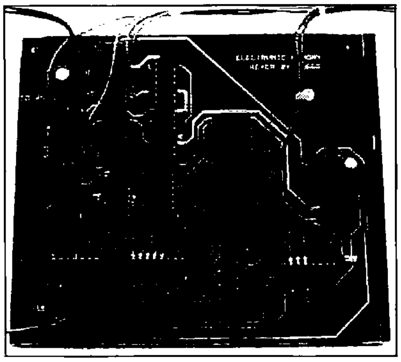


Photo B. The assembled PC board.

Brass Pounder's Keyer Parts List

Part	Description	Manufacturer
U1	NE 556 dual timer	Signetics
U2, U3, U4, U5	SN74LS93N 4-bit counter	Texas Instruments
U6, U10	SN74LS74N dual D type F/F	Texas Instruments
U7, U11	SN74LSØØN quad NAND gate	Texas Instruments
U8	SN74LSØ4N hex inverter	Texas Instruments
U9	PQ2816A 16K EEPROM	SEEQ Technology
U12, U13	SN74LS195 4-bit shift register	Texas Instruments
U14	SN74LS244 octal transceiver	Texas Instruments
R1	5.1K 10% ¼ watt resistor	Radio Shack
R2	56K 10% ¼ watt resistor	Radio Shack
R3, R8, R9, R11	10K 10% ¼ watt resistor	Radio Shack
R4	27K 10% ¼ watt resistor	Radio Shack
R5	100K potentiometer	Radio Shack
R6, R7	1K 10% ¼ watt resistor	Radio Shack
R10, R12	200Ω 10% ¼ watt resistor	Radio Shack
C1, C2, C6, C7	0.1 µF ceramic cap	Radio Shack
C3	50 µF electrolytic 35V	Radio Shack
C5	25 µF electrolytic 35V	Radio Shack
S1	DPDT miniature switch	Radio Shack
S2, S3	SPST momentary push-button	Radio Shack
S4, S5	SPDT miniature switch	Radio Shack
Q1, Q2	2N2222A NPN transistor	Texas Instruments
D1	red LED (20 mA)	Radio Shack
P1, P2	miniature phone jacks	Radio Shack

The etched and drilled double-sided PC board is available for $18 from JDM Electronics, 1974 Alpet Drive, Morgan Hill CA 95037. Add $1.50 for shipping. The U9 EEPROM is available from JDM Electronics for $7 (no charge for shipping). The complete Brass Pounder's Keyer is available in kit form (less chassis) from JDM Electronics for $70 unassembled and $85 assembled and tested, plus $2.50 shipping.

For this project, I chose a SEEQ Technology PQ2816A 16K-bit EEPROM. This is the smallest density manufactured by the company, and is available at a reasonable price. This density provides for over four minutes of recorded code. The next size larger would be the PQ2864 64K-bit EEPROM, providing for over 16 minutes of recorded code, but I felt that for most contest applications, four minutes was more than adequate. See Figure 1 for a functional block diagram of the Brass Pounder's Keyer.

Record and Playback Clocks and Modes

Two clocks are used in the keyer: a fixed frequency clock for recording, and a variable clock to allow the operator to vary the playback speed of the recorded message. The speed of the record clock is set to provide high reproduction accuracy, even at speeds up to 30 wpm. The variable clock can change the playback output speed from one-third to over twice that of the original recorded signal.

Record and play logic provides the controls necessary for either loading data into, or retrieving data from, the EEPROM. The EEPROM is a *byte parallel* random access memory device. As such, each byte (8 bits) has a unique address location in the memory. Data comes from the hand key in *bit serial* mode. The output is either a logical "1" (key depressed), or a logical "Ø" (key up).

In order to store the continuous stream of bit serial key data into a byte parallel random access EEPROM, it is necessary to do two things: First, the individual bits have to be collected and temporarily stored until a full byte is available to load into the memory; second, the address locations have to be sequentially presented to the

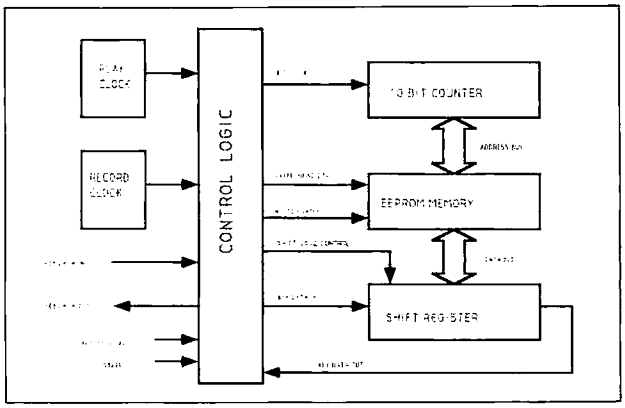


Figure 1. Functional block diagram of Brass Pounder's Keyer.

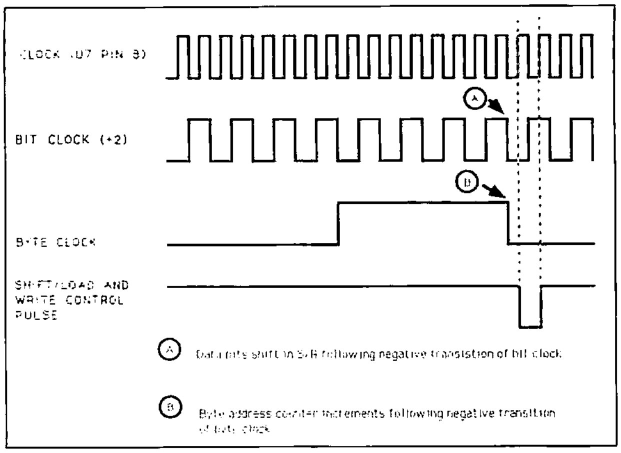


Figure 2. Timing diagram for shift/load/write control.

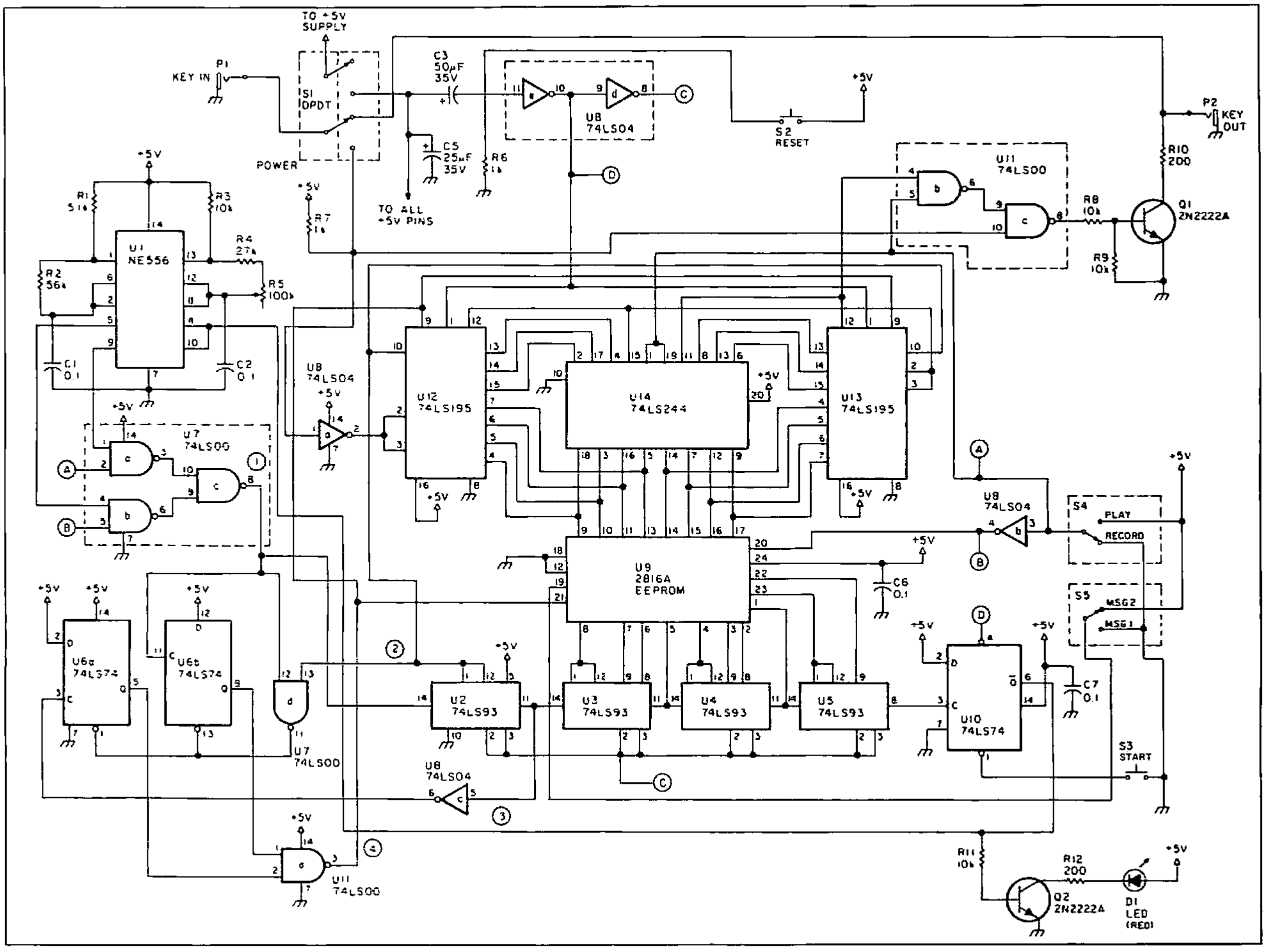


Figure 3. Schematic diagram.

EEPROM in order to seamlessly transfer the serial stream into the memory.

The first task of collecting the serial data into 8-bit bytes is accomplished by a shift register controlled by the record clock. The data recorded in the shift register is a logical "1" when the key is depressed, and a logical "Ø" when the key is open. After eight clock pulses, the shift register has a complete byte of information and is ready to be transferred to an address location in the EEPROM. This is accomplished by the record/play control logic, which momentarily inhibits shifting of any new serial data into the register, loads the contents of the shift register into one of the 1,024 memory locations of the EEPROM, and moves the EEPROM address to the next highest address by incrementing the 10-bit counter. All of this operation is performed synchronously between the end of the eighth shift register clock pulse, and before the beginning of the next shift register clock pulse. This will allow for continuous recording of the keyed data.

In the record mode, the keyer will, once started, continue to "walk" through all 1,024 address locations, recording all data presented to the input of the shift register. This takes approximately two minutes. At the completion of the 1,024th address, the clocks will automatically stop and recording is complete.

In playback mode, a reverse operation is

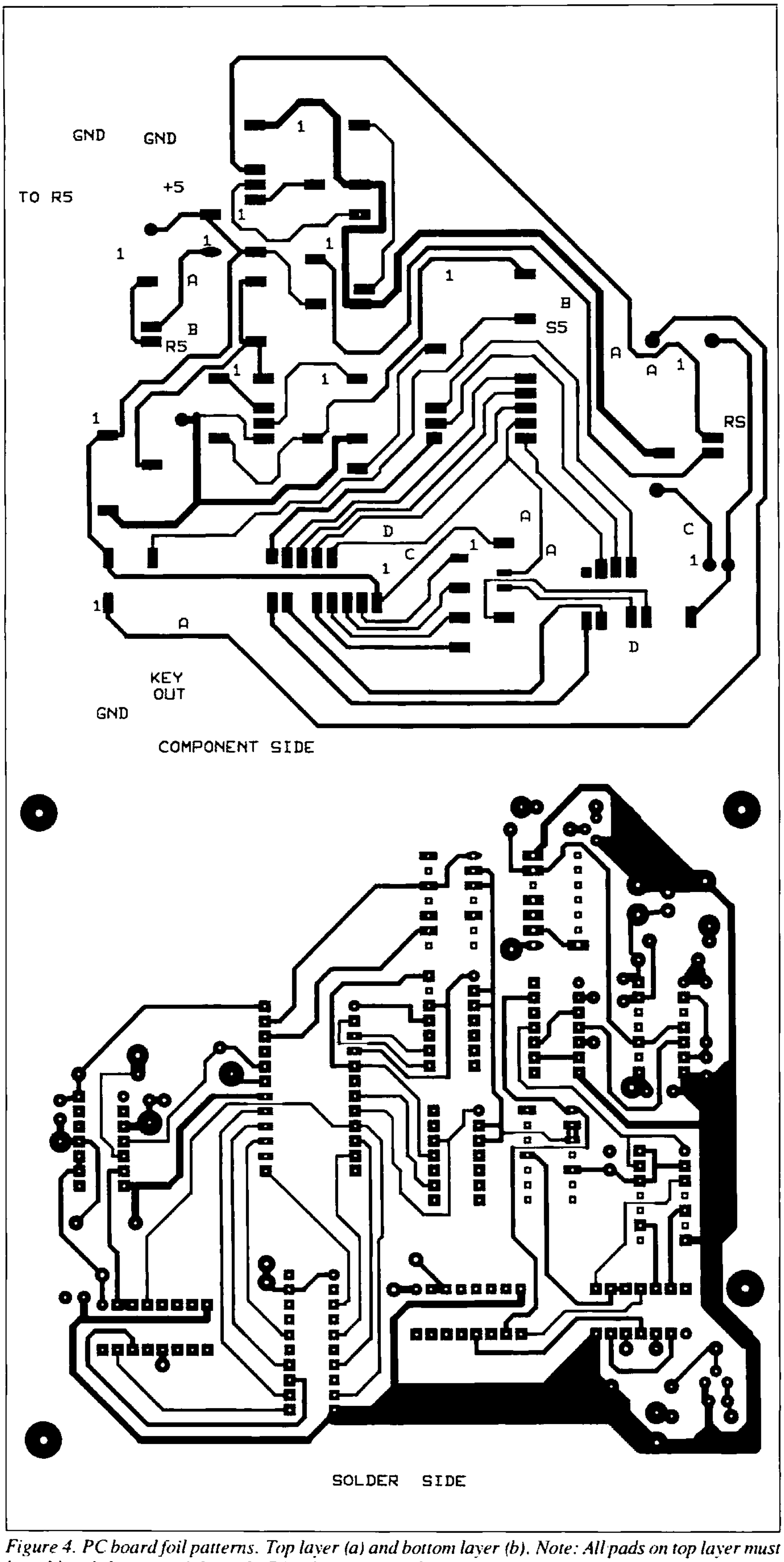


Figure 4. PC board foil patterns. Top layer (a) and bottom layer (b). Note: All pads on top layer must be soldered. Letters 'A' through 'D' indicate jumper locations.

needed. In this case, the data stored in the EEPROM will be coming out in byte parallel format and will have to be converted to bit serial. This is accomplished by first downloading the byte information from the EEPROM into the same shift register originally used to collect a byte of data from the input serial stream, and then serially shifting this information out to the key input of your rig.

In the playback mode, the play clock allows the operator to vary the playback speed. The play clock and the record/play control first transfer the contents of the first address location of the EEPROM to the shift register. This transfer is done between normal shift clock pulses, so as to make playback seamless. Following loading of the shift register, the data is then shifted out to the key-out jack. At the end of the eighth shift, the address counter is incremented and the next byte of information is loaded into the shift register. This process is continued until all 1,024 memory locations have been loaded and shifted to the key-out jack, at which time the keyer automatically stops.

Operation

The complete Brass Pounder's Keyer schematic is shown in Figure 3. Integrated circuit U1 is a NE556 dual timer that provides both the record and play clocks. The clock output of pin 5 is controlled by R1, R2 and C1. The values of these circuits provides a clock of approximately 50 Hz. R3, R4, R5 and C2 provide the variable clock with an approximate frequency range of 20 to 200 Hz. The record clock of 50 Hz was selected to provide high resolution of incoming hand-key code of up to 30 wpm, while still allowing a total of four minutes of recording from the EEPROM memory.

Clock selection, memory write and register load signals are provided by U2, U7, U6, and a portion of U8. The clock selection circuit of U7 is controlled by the record/play switch, S4. The chosen clock appears at pin 8 of U7. The clocks are turned on by control signals applied to pins 4 and 10 of U1. This is controlled by flip/flop U10. The clock starts when S3 is momentarily depressed and will run until the 1,024th count. At the end of the 1,024th count, the low-to-high transition at Pin 8 of U5 will flip U10 and stop the clocks at U1. The clocks can be restarted by momentarily depressing S3, thus resetting the U10 flip/flop.

The flip/flops and the 4-bit counter at U2 are used to provide the shift register load/EEPROM write pulse. This design was used to provide a synchronous control pulse between bit clock shifts and memory address byte shift commands. The output control pulse is present at pin 3 of U11. Figure 2 shows the timing diagram. This control pulse is applied to the EEPROM write enable signal (pin

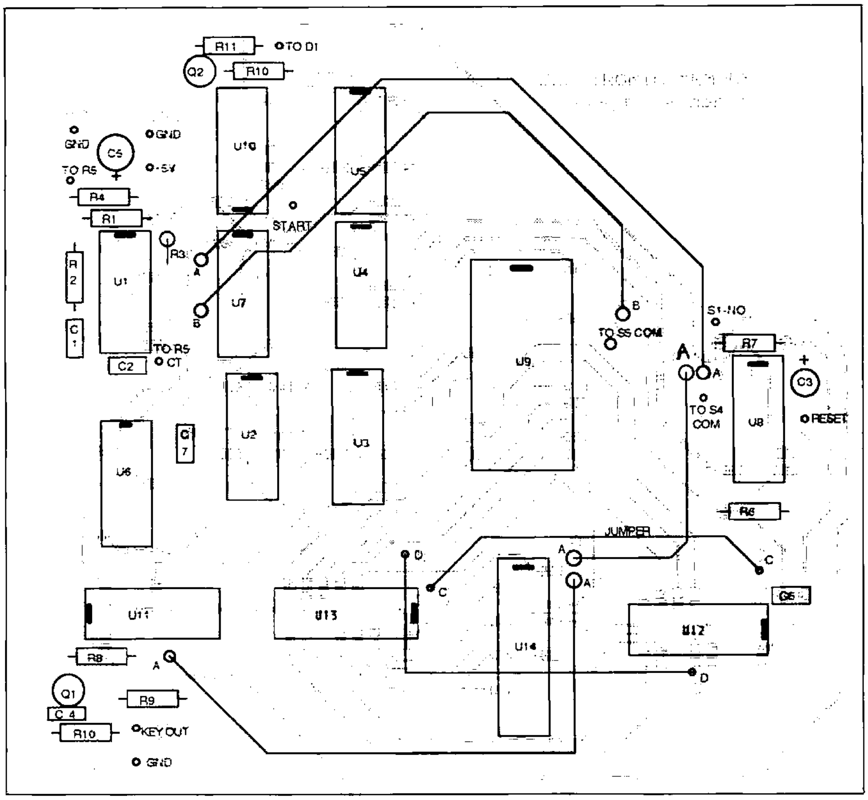


Figure 5. Parts placement (component side). Lines indicate jumper wire locations.

21 of U9), as well as the shift/register load control pin 9 of U12 and U13.

ICs U3, U4 and U5 form the 10-bit counter used to increment the address data for the EEPROM U9. The outputs of the 10-bit counter are fed into the address inputs of the 2816 EEPROM.

Data from the operator is entered into J1. The power switch, S1, is a DPDT device that allows the key to be "hard wired" directly to the key-out jack when the keyer is turned off. C3 and R4 are used to provide a momentary reset pulse to all flip/flops, counters and registers when power is first applied.

During record operation, data is fed into the first 4-bit shift register U12, and clocked by the bit clock applied from U2 pin 1. In the record mode, transceiver U14 is presenting output data from U12 and U13 in anticipation of the memory load pulse. This is accomplished by applying a low signal at pins 1 and 19 of U14.

At the end of the eighth bit clock, a write enable control pulse is generated from U11 pin 3. The EEPROM U9 then automatically latches address and data signals, erases previous contents in the addressed byte, and writes the data presented in the I/O lines to the previously specified address from U3, U4 and U5.

This record cycle will repeat until the counters U3, U4 and U5 complete 1,024 counts, at which time a low-to-high transition of U5 pin 8 will flip U10 and stop the clocks at U1.

The 2816 EEPROM (U9) is capable of storing 2,048 bytes of data, enough for four minutes of code. In the hand keyer, I elected to have a hard wire selection of two messages, each approximately two minutes long. Message selection is accomplished by S5, which is tied to the highest order address pin of U9. If your application requires a single longer message, S5 can be removed and pin 19 of U9 can be attached to U5 pin 8. In this mode, U5 pin 11 should be connected directly to U10 pin 3. These connections will allow for a single message in excess of four minutes.

During playback mode, data from the 2816 EEPROM is presented to U12 and U13, and block-loaded by the load control signal applied to pin 9 of U12 and U13. Data is then clocked out serially to J2 via the play bit clock.

The control gate of U11 pin 6 inhibits shifted data from being presented to the output during the record mode and, instead, presents the key-in signal directly to the key-out jack. The reason for doing this is to allow the operator's keying to be directly presented to the rig so that the audio tone is coincident with the operator's keying. When I first breadboarded the Brass Pounder's Keyer, I didn't have this feature, so I "heard" my keying delayed by eight-bit clock times (approximately one-quarter of a second). From firsthand experience, I can tell you that it's difficult to key code when the audio feedback is delayed by a quarter of a second! This circuit eliminated that phenomenon.

Another feature of this circuit is that it allows you to "send over" your recorded message. I found this useful, for example, when injecting RST data into my canned first response on CW QSOs.

Transistor Q1 is a garden variety 2N2222A with a small collector resistor R10, just in case I accidentally connect the output jack directly to a high-current voltage source.

The Brass Pounder's Keyer is powered by a 5 volt power supply. For my application, I connected directly to a 5 volt power supply. I also experimented with using four 1.5 volt AA Alkaline batteries, with a silicon diode in series with the load to drop the output voltage to approximately 5.4 VDC. The hand keyer consumes approximately 100 mA in standby, and about 160 in record or play. I ran the hand keyer continuously with these batteries and found that the battery life was equivalent to about 250 continuous messages. With my CW activity, I felt that I could do at least 250 messages in about three months, so I elected to use the power supply. If your usage is significantly less, and you don't have a 5 volt power supply in your shack, perhaps the internal battery pack would suit the application. Power dissipation can be reduced, obviously by removing the LED indicators. A more significant reduction can be achieved by replacing the low power Schottky devices with CMOS logic. The ready availability and extreme low cost of 74LS logic, however, was more personally persuasive when I did the first design.

Construction

For my prototype, I chose to use wire wrapping. The advantages of wire-wrapping the keyer are both speed and density. I was able to mount the wire-wrap sockets on the punched phenolic board and wire-wrap all 14 sockets in one evening. In addition, I could place the ICs side by side for maximum packing density.

The disadvantage is cost. The wire-wrap sockets ended up costing me more than some of the TTL 74LS products! The speed of assembly, however, finally persuaded me to use wire wrapping.

Another potential disadvantage (for those of us whose mind wanders from time to time during construction) is during trouble shooting. Digital circuits can behave very strangely with just one wire-wrap error, and finding the error in the rat's nest of a typical wire-wrapped board is a real challenge.

I completed the wire-wrapping project with (for me) the normal amount of de-bug headaches. To minimize construction problems for *73* readers, we decided to contract a printed circuit board design for this project, using Fred Reimers of FAR Circuits. The resulting double-sided board is shown in Figure 4. *[Note: Since the PC board doesn't have plated-through holes, it is necessary to solder the IC pins on the top layer as well, wherever a pad exists. Likewise, solder any wires both top and bottom if there is a pad on the top layer. Also be sure to run jumper wires between the lettered points as shown in Figure 5. Although the jumper wires in Photo B.*

Continued on page 32

Continued from page 28

were mounted on the bottom side (away from view), it's easier to mount them on the top side.] With the PC board, I was able to build a second unit in about one hour. . . and I didn't go blind trying to correct any wire-wrapping errors. The board level product worked perfectly. I built the board level keyer without using sockets. However, if you decide to use the printed circuit board, I recommend that you consider socketing all of the ICs.

All of the components, with the possible exception of the 2816 EEPROM (U9), should be available either at Radio Shack or at most electronics parts stores. The 2816 EEPROM is a relatively new product and tends to be available only from industrial electronic distributors, such as Anthem Electronics, Inc. For that reason, I can provide the part (see the Parts List).

Operating the Brass Pounder's Keyer

To use the keyer in your station, connect a cable between the key-out jack of the keyer and the key-in of your rig. Next, connect your hand key to the key-in jack of the Brass Pounder's Keyer.

The keyer's controls are very straightforward. For recording a message, select Message 1/Message 2, place the keyer in record mode and press the START switch. The keyer is now recording. Key in your message. At the completion of your message, wait until the keyer times out and the "complete" (red) LED is on.

To play a recorded message over the air, select Message 1/Message 2, place the keyer in play mode and momentarily press the START switch. The keyer will now play your previously recorded message. Speed of the playback is controlled by the 100k potentiometer. At the completion of your message, you may either wait until the keyer automatically times out, or depress the RESET button.

The Brass Pounder's Keyer is wired so that normal hand key operation is possible whether the keyer is on or off.

That's pretty much it. Good luck on the construction.

Contact Dan McCranie AA6GG at 1974 Alpet Drive, Morgan Hill CA 95037.

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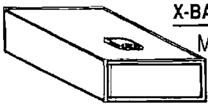

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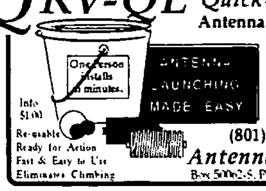

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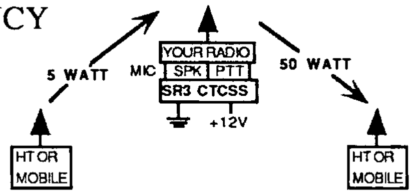

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CIRCLE 197 ON READER SERVICE CARD

SPSM Mobile Mount

Build this reliable Hustler classic.

by David A. Clingerman W6OAL

Many of us enjoy working mobile on a variety of HF bands. An average commute to work of, say, 10–20 miles will afford us a couple of QSOs before and after the work day, and maybe even a couple at noon.

Often, the problem detouring a lot of mobile operation is the problem of how to mount the antenna. Of course, we all know the best way: ball mount on the rear deck of the vehicle. That's fine and lasts a long time, but do you really want to knock a hole in the rear deck of your new $58,000 Porsche? I didn't think so, and the housefrau probably doesn't either.

The next best way is the bumper mount. Fine for an old pickup truck, but just try to get a chain or two around the bumper of some of today's sporty autos. It's next to impossible, but not totally impossible, if the auto has metal bumpers. But, usually, you'll find they're made of some sort of high impact plastic that collapses or breaks under any sort of pressure.

On down the list is the gutter clamp. Great to hold a 2 meter stinger in place, but it will only survive your 80 meter, high power, Hustler resonator and three- to four-foot extension until you round a corner pulling about 3 G's. About that time, the entire lash-up parts from the vehicle from centrifugal force, gets airborne and spears the parking attendant a block away. Or it lies flat like a scythe, and decapitates the top of a camper. No real loss, but not conducive to your longevity.

Like I said, the gutter clip is great for VHF stingers and UHF "J's," but not for arrays of any substance. The list narrows; how about lip mounts? Trunk, hood, or whatever you can get a hold on, that wonderful little device that destroys metal with its nasty set screws. Is this the answer? Or is your Mercedes much too precious to invert-dimple for the sake of a few neat QSOs to while away the travel time?

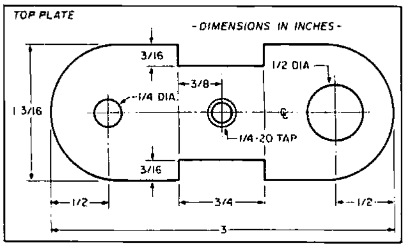

Figure 1. The top plate.

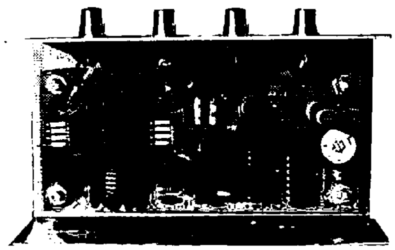

Photo A. The completed SBSM mobile installation ready to hit the road.

A Bargain Find

At one time, Hustler made a lip mount of sorts that used a compression block of cyclonic (resistant to wind damage?), high impact plastic instead of those nasty little set screws. However, when they moved their operations from Texas, they also cleaned house on a few products that weren't real movers. One of these items was the SPSM mobile mount. I picked one up from a bargain table for a dollar at R&L Electronics in Hamilton, Ohio, just because I'd never seen one before, and secondly because it was only a dollar. As things worked out, it was one of the best dollars I ever spent.

A Pontiac Fiero, as some of you probably know, has an all-fiberglass body, a difficult thing to try to find a ground point on. But the SPSM mount worked just great on the rear deck, as there arc two metal ventilators which actually attach somehow to chassis ground. Also, the SPSM can be compression-fit to a fiberglass edge, with a short piece of braid and ground clip attached to one of the ventilators.

This mount worked great for supporting my Hustler RMX 10 meter antenna and a standard stainless steel (102") CB whip, though not both at the same time.

I tired of the Fiero and purchased a van. The Plymouth Voyager has a lift-type rear door with edges that are just perfect for mounting the SPSM. The SPSM worked so well I wanted a second one for mounting my 2 meter "J" on the opposite side of the van.

Construction

I contacted Hustler to see if they had any more SPSMs, or parts still around that I might buy. They didn't have a trace, not even any drawings. Many years of special project work in the Navy taught me that if you need it and it doesn't exist, you have to build it yourself. After a few hours of sawing, tapping, and drilling, I had my very own SPSM mount. It was worth it. I feel this little mount is so versatile that I would like to share my construction with you.

The Top Plate

I acquired some strap stainless steel (1.2" wide x 0.1875" thick x 36" long) at the local ACE hardware store for about $3.50 and a couple of 1/4-20 stainless steel nuts and bolts for about $1. Using a band saw, I cut a 4" length of stainless from the flat stock. Then I rounded the corners with a bench grinder to a 1/2" radius. Let's call this item the "top plate."

On each of the long side dimensions of the top plate, and evenly centered, I used a flat file to grind in ¾" long slots to a depth of 3/16". I then drilled two holes centered about ½" from each end of the top plate. Drill one of the holes to a diameter of 0.250" and the other to 0.375". In the center of the top plate drill a 3/16" hole and tap it with a 1/4-20 die. See Figure 1.

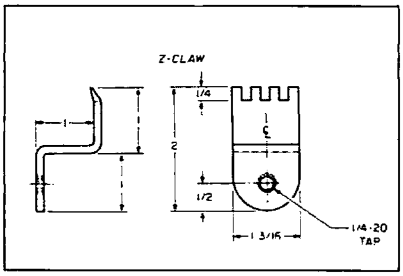

Figure 2 (a). Side view of the Z-claw. (b). Top view.

The Z Claw

I cut another piece of stainless from the flat stock. This one was 3" long. I rounded the corners on only one end to a radius of 1/2". Drill a 3/16" hole at a point ½" in from the rounded end. Then tap it for a 1/4-20 hole. I placed 1" of this end in the vise to effect a 90 degree bend using a ball peen hammer. Next, I placed the opposite end 1" in the vise, and made another 90 degree bend in the opposite direction of the first bend. This makes the device almost "Z" shaped. I'll call this piece the "Z-claw."

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The Z-claw should be placed with the top plate so that the 1/4-20 holes line up. Grind the bottom side of the square end until it's sharp. Using a flat file, your next task is to make four teeth in this sharp end. To do this, you need to file three notches ¼" deep. Bend these teeth about 10 degrees toward the top plate, using the ball peen hammer. This completes the Z-claw. See Figure 2.

The Compression Block

I didn't have any hard or "cyclonic" plastic around, so I used a piece of hardwood (maple) to produce the third device, known as the "compression block." This object is drawn in Figure 3, and is probably easier to see than to describe in words. I made it using a band saw, a drill press, and a flat file. First make two saw cuts about ½" deep into the wood block (vertical sections of the channel). Then take a wood chisel to chop out the channel. If you take a look at Figure 3, you'll see a ⅜" diameter hole in the center of the compression block. Be careful to drill only to the depth shown in the drawing (⅜"), otherwise the compression block loses its compression.

I cut a ¾" length from a ⅜" O.D. steel rod and drilled it right down the center with a ¼" drill (its "Z" axis) to a depth of ⅝". About ¼" from the open end of this "cup" I drilled three holes 120 degrees from each other around the periphery, and tapped for 4-40 set screws. See Figure 4.

I used a small triangular file to score a 1/16" deep circular groove into a 1.5" long 1/4-20 bolt ⅜" from its threaded end. Next, I screwed this "prepared bolt" into the center hole of the top plate, all the way to the bolt head. Slip the little cup affair with the three set screws over the bolt, and snug the set screws into the groove so that the cup can just barely turn freely. Press the cup affair into the ⅜" diameter hole of the compression block and bottom it out. Then back out the 1/4-20 compression block drive bolt until the hardwood compression block is snugged up against the top plate.

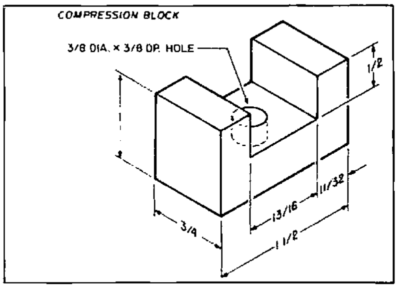

Figure 3. The compression block.

Affix the Z-claw to the top plate with a 1/4-20 bolt and snug it to the point where the Z-claw swings freely beneath the top plate. The teeth of the Z-claw, as you'll see, line up about the center of the bottom of the compression block so that when the drive bolt is screwed toward the teeth, considerable compression can occur. You can use a locking nut beneath the head of the drive bolt and tighten it against the top plate if you want. I didn't use one because I felt that, especially under tension, the drive bolt was not likely to unscrew.

Photo B. Closeup view of the SBSM mount.

Once you have affixed a small "ball mount assembly" to the top plate in its remaining hole, you will have created an SPSM just like Hustler used to make. See Figure 5.

Application

It's easy to install this device. You simply turn the Z-claw out from the compression block, and insert it under any metal or plastic lip of a vehicle. Swing the compression block/top plate assembly over the lip, align the compression block over the teeth of the Z-claw with the metal or plastic lip between, and tighten down on the compression block drive screw. The surface of the metal or plastic won't be harmed, or at least very little, by the hardwood compression block.

The teeth of the Z-claw will dig in slightly to the underside of the lip, but that will not be in view, and if metal, it can be hit with a shot of Rustoleum™ to prevent any oxidation. The teeth digging into the metal will affect a good ground at the mount. Regardless of the position in which the SPSM is mounted, the small ball assembly will always have two degrees of freedom which should allow enough latitude for almost any situation you can imagine. All you have to do now is mount your mobile antenna and mobile away.

My first test run in my vehicle to ascertain mechanical integrity entailed a trip down the

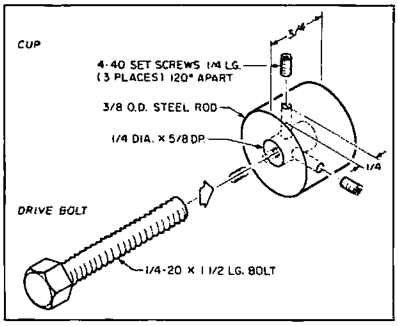

Figure 4 (a). Details of the "cup" construction. (b). The completed drive bolt arrangement.

Parts List

1 Stainless steel strap (0.1825" thick), 1.2"W x 3'L
2 ¼-20 x 1 1/2" bolt
1 Length of ⅜" steel rod
3 4-40 x ¼" set screws
1 Block of hardwood (1"H x ¾"W x 1½"L)
1 Ball antenna mount

Santa Fe Trail, south out of Littleton, Colorado, at a speed of about 60 MPH. Nothing fell off in the first few miles, so I tried a few QSOs to see if the device would also work electronically. I made a number of contacts all over the country. My third QSO was with none other than Bill Brown WB8ELK in Hancock, New Hampshire, giving a demonstration of the *73* hamshack to a group of students.

Good luck in your construction endeavors and enjoy your mobile operations with the knowledge that your antenna will remain firmly in place! 73

You may reach David A. Clingerman W6OAL at 4725 W. Quincy #1014, Denver CO 80236.

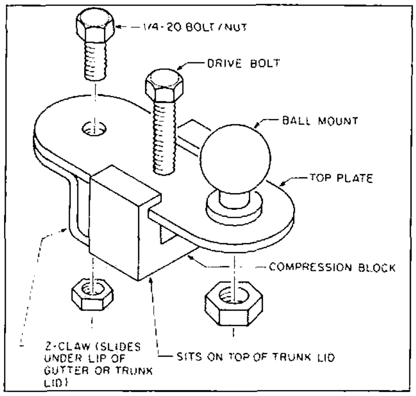

Figure 5. Final assembly of the mount.

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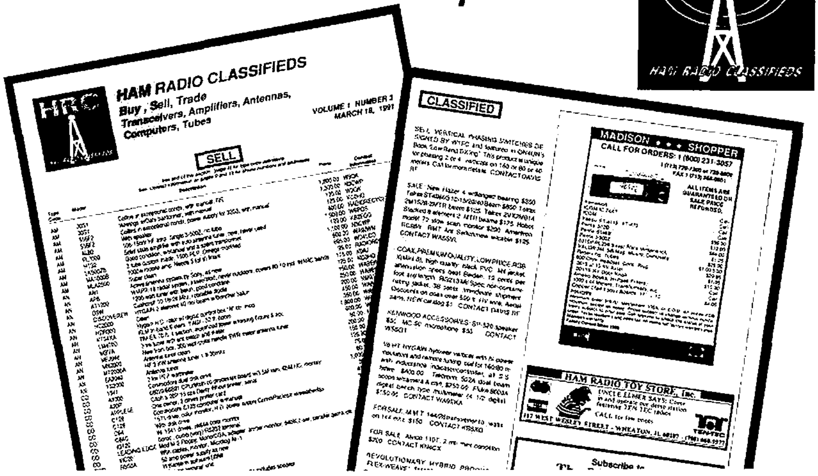

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CIRCLE 267 ON READER SERVICE CARD

73 Review

by David Cassidy N1GPH

Tripp Lite PR-25A Power Supply and Isobar 8 GS Surge Suppressor

Tripp Lite
500 North Orleans
Chicago IL 60610-4188
Tel. (312) 329-1777;
FAX (312) 644-6505.
Price Class: PR-25A, $180; Isobar 8 GS, $115.

The PR-25A

A good 12 volt power supply is probably the most used accessory in any ham shack. Just think of all the things you call upon your power supply to run: HF rig, 2 meter gear, packet station, amplifier . . . The lowly power supply just sits there, spitting out the amps, day after day, year after year.

Unless you splurged and bought the matching 12 volt supply with your HF rig, your power supply probably looks like a cross between a billboard and a refrigerator—a big metal cabinet covered with all kinds of ominous writing. After all, it's only a power supply. Hook it up, throw it under the desk and forget it—right?

The Tripp Lite company has recently upscaled their line of power supplies. The new cabinets are an attractive charcoal color, to match modern communications equipment. Since power supplies in the 25 amp range seem to be the most versatile for amateur use (you can power everything from an HT to a standard 100W transceiver), I took a look at the Tripp Lite PR-25A (Tripp Lite offers supplies in 3—60 amp sizes, with prices starting at $38.50).

The PR-25A is housed in a sturdy cabinet and weighs in at about 20 pounds. The cabinet is well ventilated, and even during all-afternoon sessions in the shack, it did not get more than slightly warm. Two rear-mounted bolts provide connection to your power cable. These bolts are clearly marked, so unless you're not paying attention, chances of reversing your power leads are slim (it's a good idea to always check one more time before powering up your gear). A large rocker switch is the only thing (other than the company logo and model number) on the front panel, glowing red to show when the unit is turned on.

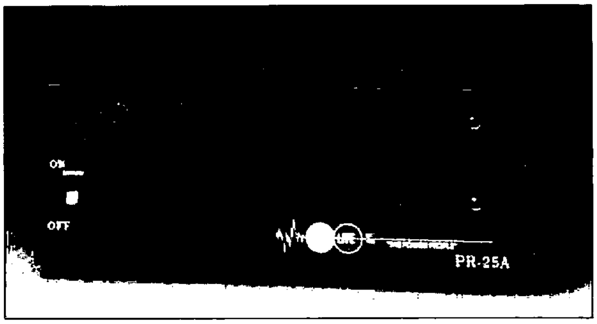

Photo A. The PR-25A power supply.

The PR-25A is rated at 20 amps continuous duty cycle, so I tuned the RTTY portion of 15 meters to see how it would measure up. Even during long transmissions of over five minutes at 50 watts output, the PR-25A never dropped below 22 amps and 13.1 volts. (Remember, even though we call them 12 volt supplies, they all provide 13.8 volts.) Even at short-duration, full-power transmissions (one to two minutes at 100 watts), the PR-25A continued to provide a minimum of 22 amps and 13 volts.

I now have the PR-25A powering my packet setup (HT and 30 watt 2 meter amp), as well as a 45 watt 2 meter mobile rig. I can run all three pieces simultaneously, and the PR-25A never misses a beat.

The Isobar 8 GS

Most of us who use computers are familiar with surge suppressors. They protect delicate computer chips from the occasional voltage surge. These surges occur everywhere from time to time, and are more frequent in rural areas (like where I live). If you plug your computer directly into your wall socket, it's only a matter of time before a line surge does something nasty—from wiping out a file or hard disk, to frying your RAM chips.

Since modern ham transceivers are really computers (your average low-end transceiver has more computing power than an entire room full of early computers), I am often surprised to see hams going to all kinds of trouble to protect their computer and then simply plugging their transceiver into a wall socket (often on the same circuit with other high current appliances). The chips inside your HF rig are every bit as susceptible to line surge as your computer, and you ought to consider using a surge suppressor.

Tripp Lite's Isobar GS line offers a couple of unique features. Tripp Lite provides its Gold Seal Warranty on the complete line of Isobar GS surge suppressors. The warranty covers not only the Isobar itself, but any equipment plugged into the Isobar. If surge damage occurs, the Isobar *and* the equipment will be repaired or replaced (contact Tripp Lite for details).

The Isobar GS also features isolated filter banks, preventing connected equipment from causing interference with each other. What Tripp Lite calls "Cascade Circuitry" allows you to choose the amount of suppression you need for various pieces of equipment. For instance, the 8-outlet Isobar provides 50, 75, 100 and 120 dB suppression.

The Isobar GS is available in 2, 4, 6 and 8 outlet models, with prices starting at $59.95. You'll feel better knowing that your expensive rig is protected from line surges. ■

David Cassidy is the Associate Publisher of 73 Amateur Radio Today.

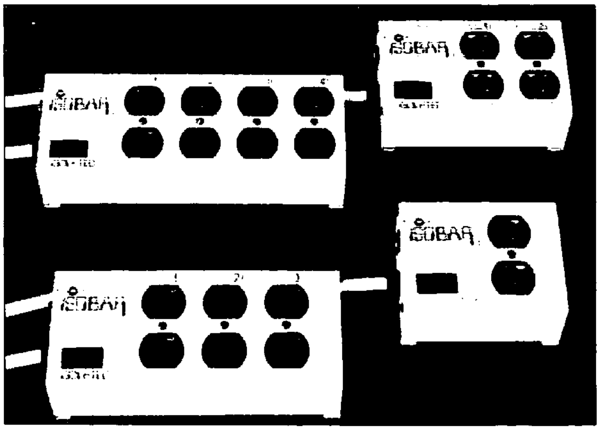

Photo B. The Isobar 8 GS surge suppressor.

Parts Substitution

A beginner's guide.

by Bruce S. Hale KB1MW/7

As I look through the latest issue of 73, a construction article catches my eye. Let's see if I have the parts. As usual, I have most, but not all, of them. And also as usual, Radio Shack doesn't have everything that I need. I could mail-order the parts, but I can't get them all from one place, and I can't put together a minimum order for any one mail-order company. Oh, well. Another project for the "if I ever find the parts" file.

Sound familiar? Maybe it's one reason why "nobody builds anymore." In the old days, they'll tell you, everyone built with standard parts, and if you needed something, you could substitute one standard part with another. Today, there are too many "special-purpose" parts. But is that really true?

There are a few special parts these days, mainly large-scale ICs. But there are also quite a few standard parts you can substitute for what looks like a special part, if you know how. My experience in building has taught me a few tricks, and I'd like to share them with you.

Can I Use This Resistor?

With resistors, the *power rating* is your main concern. You're always safe using a resistor with a power rating *greater* than what the designer specified. If the designer used a ¼-watt resistor and you've got a 1-watter, go ahead and use it. It will be a bit larger, but so what, if it saves you from waiting for mail order?

Using a smaller resistor is generally a bad idea. You could try to calculate or measure the current and power dissipation, or try it and see if you "let the smoke out of it," but you might be right on the edge of causing the part to fail. Failure might occur only after you've used the device for a while, and it could take something expensive with it!

If the design doesn't specify the resistor power rating, you can usually get away with ¼-watt parts (especially in digital circuits, 12V receivers, and low-power transmitters). If you have ½-watt parts, they're OK, too.

Resistor *tolerance* is another important parameter. Resistors typically come in 10%, 5%, and 1% tolerances. The tolerance is the amount that the value of the component can vary from the value printed on the resistor. If the tolerance is critical for a project, the design will usually specify it. If the design calls for 1% resistors, don't use 10% parts! On the other hand, going towards *better* tolerance is OK. Using a 1% resistor where a 5% value will do is a waste of money, but the device will work.

To rate parts for tolerance, manufacturers usually measure each part. It's impossible to manufacture parts that all stick to a close tolerance, but some of the parts in a given batch will be within 1%, a few more will be within 5%, and most will be within 10%. So as the parts come out of the manufacturing process, they are measured and placed in bins according to tolerance. This means that the 10% resistors will most often not be any closer than 5% of the given value. If they were within 5%, they'd be in the 5% bin! Some of the 10% parts will be on the high side, and some will be on the low side. Keep this in mind if you use 10% parts. The best way to be sure of the value is to use a digital multimeter to measure each resistor.

As for the actual value of the resistor, pay attention to the tolerance the designer specified, and use it to your advantage. If the design specifies 2.2k at 10%, the expectation is that anything plus and minus 10% from 2.2k will work. This means anything from 2k to 2.4k should be OK here. With larger value resistors, the percentage gives you an even wider margin for substitution.

Remember the series/parallel formulas you had to learn for your exam? Here's a chance to put them to use. If you need a 2.2k resistor, but all you've got is a box of 4.7k resistors, use two of the 4.7k's in parallel! That gives you the equivalent of a 2.35k resistor. If you use your imagination, you can usually come up with some combination of the values you have on hand that will equal the value you need. If you keep a good stock of some "standard" values, like 470, 1k, 4.7, 10k, and so on, your substitution job will be that much easier.

Did the designer specify a particular type of resistor (carbon-film, carbon composition, or metal film)? Usually, you can interchange types; if you have a carbon-composition resistor, and the design calls for carbon-film, you're probably OK (as long as your power and tolerance ratings are OK). If the type of resistor is important, the designer should specify it: "R1 must be a carbon-film resistor." If this is specified, don't substitute.

Pull-up Resistors

A pull-up resistor is a special case for parts substitution. What's a pull-up? It's usually one of the only resistors in a digital circuit, connected from one or more unused IC inputs to the power-supply (usually 5 volts). It "pulls up" the unused inputs and keeps them from "floating."

This is one case in which you can substitute a wide variety of parts. The designer may use 1k or 10k resistors for pull-ups. You can generally substitute *anything* within this range.

Smaller values will probably work, but they may increase the circuit's power consumption. Larger values may also work (especially in a low-power CMOS circuit), but they may also be unreliable. It's best to stay within the 1k to 10k range. As always, if you have the value the design specifies, use it!

What About This Capacitor?

With capacitors, the important parameter is the *voltage rating*. Again, it's always safe to use a capacitor rated at a higher voltage than the designer specified. A higher voltage rating just gives you a greater margin of safety. If the design specifies a 50V cap, and you have a 100V cap, use it. On the other hand, you're asking for fireworks if you use a cap with a lower voltage rating than the design calls for.

If the designer doesn't specify the voltage rating, it's best to use caps rated at twice the power-supply voltage or more. For example, using 25V caps in a 12V circuit is fine, but using 50V caps in a 150V circuit is a *bad* idea.

Here again, you can use the series/parallel formulas to combine capacitance to get the value you need. Understanding the way voltage and current divide through series and parallel capacitor combinations is a bit more difficult than with resistors; try to stick with capacitors that have at least the specified voltage rating, even if you use a series or parallel combination.

Capacitor *tolerance* is also important. There are even more kinds of capacitors than there are resistors, and the tolerance can vary widely, depending on the capacitor type. In addition, capacitors are much more sensitive to temperature, and their value may shift widely as your circuit heats up. Disc-ceramic capacitors are usually the worst. They can vary as much as 80% from the printed value!

There are some special purpose ceramic caps, however, such as the NPO (negative-positive-zero or n-p-zero, but *not* n-p-oh). These caps should be used in VFO circuits where their *temperature coefficient* (capacitance drift as the temperature varies) is the important factor. Standard disc ceramic caps will drift all over the place, which makes them unsuitable for VFO use. NPO caps hardly drift at all. If the design specifies NPO, don't use a standard cap.

What about "silver-mica" and "polystyrene" capacitors? As far as drift goes, these are almost as good as NP0 caps. If you can't find an NP0, try either of these two. But again, if the design calls for one of these three types, don't substitute a standard cap! If you have to use a silver-mica where a standard ceramic is called for, that's OK, but you're "gilding the lily" and wasting money.

Large-value capacitors (above about 2 µF) usually come in two types: tantalum and aluminum electrolytic. Both types are polarized, and must be wired into a circuit in a particular way. Some people like to use tantalum caps because they're small. They do have advantages over aluminum electrolytics—tantalum caps have lower leakage current and closer tolerances. Their actual value will be closer to the printed value, and the value will change less with temperature and time.

This makes tantalum caps ideal for RC timing applications, where you want the cap to hold a charge for a long period, and you want the circuit to be easy to duplicate. Most of the time, it's not a good idea to substitute a regular aluminum electrolytic for a tantalum capacitor. This is one of those places where the designer should help you out and tell you if it's important to use a tantalum cap. If you really can't find the specified part, go ahead and try the aluminum cap.

Bypass Capacitors

Bypass capacitors are like pull-up resistors when it comes to substitution. A bypass cap is usually connected from the power-supply pin of an IC to ground. The bypass cap gets rid of any AC spikes or noise on the power-supply voltage. You can use just about anything from 0.001 µF to 0.1 µF for a bypass cap, and any type of capacitor is fine. Most designers use 0.001, 0.01, or 0.1 µF caps because those values are easy to keep around. If you plan to build a lot of digital circuits, you should also try to keep a good stock of these values handy in your junk box.

You may also see higher-value capacitors (between 10 and 100 µF) connected from the power supply to ground near where the power connects to a digital circuit board. These are also bypass capacitors. While just about any value in this range will work, the designer may specify tantalum capacitors in a low-power circuit. Leakage current is the important factor here. Even though capacitors block the flow of DC, there will usually be some small leakage through the capacitor, and this leakage can be much higher with aluminum electrolytic capacitors. It's still very small, however, and you can almost always forget about it, especially if you are using an AC power supply. If a tantalum cap is critical, the designer should tell you.

Using Transistor Substitution Guides

Transistor selection was a thorn in my side for quite a while. It seemed like every time I wanted to build a project I had everything but one or two of the transistors. I've since learned that I could have built most of those projects with a few standard transistors.

The table shows some of these "standard" transistors. With a little creative research, you can probably substitute one of the transistors in the table for the device in that circuit you're working on.

Most transistor manufacturers (and a few parts companies) publish transistor substitution guides. You can use any one of these guides as a cross-reference to find a replacement from the table. The substitution guide will usually give you the manufacturer's standard replacement for the part. Write that number down, then look up the replacements for the transistors in the table. If the manufacturer recommends the same substitute for one of the standards, you're in business. You don't need the special part; one of the standards will do.

One other thing about transistors—you may see some deviation from the typical "2NXXXX" part numbers. For example, a PN2222 is simply a 2N2222 in a plastic case ("P" for "plastic"). Keep this in mind as you search for parts.

Manufacturer's Part Numbers

And then there are those cryptic IC designation numbers. What's the difference between a DM74151AN and an SN74151A? Each comes from a different manufacturer. Will both of them work in the same circuit? You bet. Each has the same part number: 74151A. The "baggage" in the designator is manufacturer information.

On the other hand, if a design calls for a 74LS00, and you have a 7400 IC, you might not get away with substituting your IC in the circuit. Letters in the *middle* of an IC designator tell you about the IC family. The "LS" in this part number means "low-power Schottky." There are many more IC families, but that's a subject for another article. Just remember that letters at the beginning and end of an IC number aren't usually important, but letters in the middle are.

Some Standard Transistors

Part Number	*Type*	*Typical Use*
2N3904	NPN	oscillator, switch
2N4123	NPN	oscillator, switch
2N4124	NPN	oscillator, switch
2N4401	NPN	oscillator, switch
2N2222	NPN	oscillator, switch, low power amp
2N3053	NPN	medium power amp
2N3553	NPN	medium power RF amp
2N3866	NPN	medium power RF amp (to VHF)
2N3906	PNP	oscillator, switch
2N4037	PNP	oscillator, switch
2N4125	PNP	oscillator, switch
2N4126	PNP	oscillator, switch
2N4403	PNP	oscillator, switch
2N2907	PNP	medium power switch

Catalogs, Books, and Magazines

Parts supply catalogs are usually full of information. You can use a lot of this information to help you find substitutes for hard-to-find parts. Write or call parts companies and ask for their catalogs. Some of them charge a small fee, but the catalogs are usually worth it as reference material.

Read all the construction articles you can find. Look at the schematics. You'll start to see patterns after a while. Most engineers don't re-invent the wheel—if there's a good design out there, you'll see parts of it in other circuits. Keep a file of schematics; when you find something you want to build, check through your file for similar circuits. You may see the same basic circuit using a different transistor—maybe one that's easier to find!

Join a Club

Nothing beats being able to ask someone who has more experience than you. Try to find a club where some of the members build their own gear. If no one is building, encourage them to. You may start something. Even if they're not building, most hams can tell you stories about when they did build, and you can pick up a lot of useful information.

Build and Experiment!

Parts substitution is really not that difficult. The best way to find out what works is to build! Don't be afraid to experiment; if you're not sure about something, try it, and keep a record of your results. You'll learn a lot, and you'll have fun as you learn. That's what home-brew ham radio is all about. 73

Three Bands with One Rock

Continued from page 11

was possible, but with about half the output power.

Improvements

The transmitter is a broad-band design. With appropriate output filters, you can transmit on 30 or 17 meter operation. The crystals must be fundamental mode, and no division from other bands results in the needed frequencies. Frequencies above 20 MHz are usually third harmonic types that will probably either oscillate at their fundamental frequency or be very chirpy.

Acknowledgments

The design is a mixture of many QRP rigs that have come before. Certainly no one has written more on the subject than Doug DeMaw. His *QRP Notebook*, available from the ARRL (and "Uncle Wayne's Bookshelf"), is an invaluable resource for QRP designs. *QRP Classics*, an excellent anthology of past *QST* articles, is another. It is also available from both sources.

I'd like to thank the many members of the Allen-Bradley Company Amateur Radio Club, who helped in the preparation of this project. 73

Mike Gasperi WW9X, 4529 W. Johnson Ave., Racine WI 53405.

Software for the Ham Shack, Part II

Useful ham calculations you can program yourself!

by Bill Clarke WA4BLC

With luck, you have the first part of your ham computer system up and running (if not, see Part I in the May 1991 issue). In fact, you may well have new wire antennas all over the yard that you have designed with your computer. Now it's time to add a little more to the system. This month the MAIN MENU will grow to five choices. These will be added to the first two in Part I:

3 - OHM'S LAW
4 - POWER FORMULAS
5 - EFFICIENCY FORMULA

Module Three

Make your selection from the OHM'S LAW menu, selection 3 of the MAIN MENU, and the computer will figure the unknown value for you.

Module Four

With the POWER FORMULAS menu, you can figure power output in watts. Just select the proper menu choice, and the computer will do all the math work for you.

Module Five

Just how efficient is your rig or amplifier? Merely enter the input and output powers, and the computer will tell you the percentage of operational efficiency.

Entering the Listing

Before you add program lines from this month's listing, you must first LOAD HAM1 (again, see last month's issue; if you don't have it, you can call or write the *73* editorial office for one). After it's loaded, LIST it. Then you're ready to start typing. Don't worry if some of the lines appear out of order. The computer will straighten out all the problems during the SAVE, after you finish entering the program lines.

There are quite a few lines to enter this month, so take your time and be careful. You might be well advised to enter part of the listing, save it, and take a break. Come back later, reload, and add the remaining lines.

After you have completed typing in all the lines, you must SAVE your work. Save it under the name HAM2.

Don't forget to use the modifications for the C-64 which were listed in Part I of this series.

Listing for HAM2

C-64 Users: Don't forget to make the modifications listed in Part I of this article series.

```
16 PRINT SPACE$(26);"3 - OHM'S LAW"
17 PRINT SPACE$(26);"4 - POWER FORMULAS"
18 PRINT SPACE$(26);"5 - EFFICIENCY FORMULA"
34 IF M$ = "3" THEN 300
35 IF M$ = "4" THEN 400
36 IF M$ = "5" THEN 500
300 CLEAR : CLS
301 PRINT SPACE$(30);"OHM'S LAW"
302 PRINT SPACE$(20);"------------------------------"
303 PRINT : PRINT : PRINT
310 PRINT SPACE$(26);"1 - UNKNOWN CURRENT"
311 PRINT SPACE$(26);"2 - UNKNOWN VOLTAGE"
312 PRINT SPACE$(26);"3 - UNKNOWN RESISTANCE"
315 M$ = INKEY$
316 IF M$ = "1" THEN 320
317 IF M$ = "2" THEN 330
318 IF M$ = "3" THEN 340
319 GOTO 315
320 CLEAR : CLS
321 PRINT SPACE$(30);"OHM'S LAW"
322 PRINT SPACE$(20);"------------------------------"
323 PRINT : PRINT : PRINT
324 INPUT "ENTER THE VOLTAGE IN VOLTS:    ";E
325 INPUT "ENTER THE RESISTANCE IN OHMS: ";R
326 I = E/R
327 GOSUB 390
328 PRINT : PRINT"THE CURRENT IS: "FNA(I)" AMPS"
329 GOTO 380
330 CLEAR : CLS
331 PRINT SPACE$(30);"OHM'S LAW"
332 PRINT SPACE$(20);"------------------------------"
333 PRINT : PRINT : PRINT
334 INPUT "ENTER THE CURRENT IN AMPS:    ";I
335 INPUT "ENTER THE RESISTANCE IN OHMS: ";R
336 E = I*R
337 GOSUB 390
338 PRINT : PRINT"THE VOLTAGE IS: "FNA(E)" VOLTS"
339 GOTO 380
340 CLEAR : CLS
341 PRINT SPACE$(30);"OHM'S LAW"
342 PRINT SPACE$(20);"------------------------------"
343 PRINT : PRINT : PRINT
344 INPUT "ENTER THE VOLTAGE IN VOLTS: ";E
345 INPUT "ENTER THE CURRENT IN AMPS:  ";I
346 R = E/I
347 GOSUB 390
348 PRINT : PRINT"THE RESISTANCE IS: "FNA(R)" OHMS"
349 GOTO 380
380 PRINT
381 PRINT "N - TRY AGAIN"
382 PRINT "M - MAIN MENU"
383 M$ = INKEY$
384 IF M$ = "N" THEN 300
385 IF M$ = "M" THEN 10
386 GOTO 383
390 DEF FNA(I) = INT (I*100+.5)/100
391 DEF FNA(E) = INT (E*100+.5)/100
392 DEF FNA(R) = INT (R*100+.5)/100
393 DEF FNA(P) = INT (P*100+.5)/100
```

(Continued)

Using the New Program

LOAD the new program by typing LOAD "HAM2" and pressing ENTER. When the computer signals READY on the screen, type RUN and press ENTER.

The next thing you should see is the MAIN MENU for your new HAM SYSTEM. It should show five selections: ANTENNA DESIGN MATH, TRANSMISSION LINE MATH, OHM'S LAW, POWER FORMULAS, and EFFICIENCY FORMULA.

Next month, in Part III of this four-part series, you'll add modules six and seven: RADIO HORIZONS and OHMS TO RESISTOR COLORS to your ham shack software. ■

You may reach Bill Clarke WA4BLC at RD#2 Box 455-A, Altamont NY 12009.

```
394 DEF FNA(D) = INT (D*100+.5)/100
395 DEF FNA(L) = INT (L*100+.5)/100
399 RETURN
400 CLEAR : CLS
401 PRINT SPACE$(28);"POWER FORMULAS"
402 PRINT SPACE$(20);"------------------------------"
403 PRINT : PRINT : PRINT
410 PRINT SPACE$(23);"1 - KNOWN VOLTAGE & CURRENT"
411 PRINT SPACE$(23);"2 - KNOWN VOLTAGE & RESISTANCE"
412 PRINT SPACE$(23);"3 - KNOWN CURRENT & RESISTANCE"
415 M$ = INKEY$
416 IF M$ = "1" THEN 420
417 IF M$ = "2" THEN 430
418 IF M$ = "3" THEN 440
419 GOTO 415
420 CLEAR : CLS
421 PRINT SPACE$(28);"POWER FORMULAS"
422 PRINT SPACE$(20);"------------------------------"
423 PRINT : PRINT : PRINT
424 INPUT "ENTER THE VOLTAGE IN VOLTS: ";E
425 INPUT "ENTER THE CURRENT IN AMPS:  ";I
426 P = E*I
427 GOSUB 390
428 PRINT : PRINT"THE POWER IS: "FNA(P)" WATTS"
429 GOTO 480
430 CLEAR : CLS
431 PRINT SPACE$(28);"POWER FORMULAS"
432 PRINT SPACE$(20);"------------------------------"
433 PRINT : PRINT : PRINT
434 INPUT "ENTER THE VOLTAGE IN VOLTS:    ";E
435 INPUT "ENTER THE RESISTANCE IN OHMS: ";R
436 P = (E*E)/R
437 GOSUB 390
438 PRINT : PRINT"THE POWER IS: "FNA(P)" WATTS"
439 GOTO 480
440 CLEAR : CLS
441 PRINT SPACE$(28);"POWER FORMULAS"
442 PRINT SPACE$(20);"------------------------------"
443 PRINT : PRINT : PRINT
444 INPUT "ENTER THE CURRENT IN AMPS:     ";I
445 INPUT "ENTER THE RESISTANCE IN OHMS: ";R
446 P = (I*I)*R
447 GOSUB 390
448 PRINT : PRINT"THE POWER IS: "FNA(P)" WATTS"
449 GOTO 480
480 PRINT
481 PRINT "N - TRY AGAIN"
482 PRINT "M - MAIN MENU"
483 M$ = INKEY$
484 IF M$ = "N" THEN 400
485 IF M$ = "M" THEN 10
486 GOTO 483
500 CLEAR : CLS
501 PRINT SPACE$(26);"EFFICIENCY FORMULA"
502 PRINT SPACE$(20);"------------------------------"
503 PRINT : PRINT : PRINT
524 INPUT "ENTER THE POWER OUTPUT IN WATTS: ";O
525 INPUT "ENTER THE POWER INPUT IN WATTS:  ";I
526 X = O/I : E = 100*X
527 GOSUB 390
528 PRINT : PRINT"THE EFFICIENCY IS: "FNA(E)"%"
529 GOTO 580
580 PRINT
581 PRINT "N - TRY AGAIN"
582 PRINT "M - MAIN MENU"
583 M$ = INKEY$
584 IF M$ = "N" THEN 500
585 IF M$ = "M" THEN 10
586 GOTO 583
```

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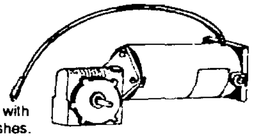

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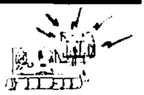

This NEW compact flash assembly comes from a U.S. manufacturer of cameras. Unit operates on 3 Vdc and measures 2 1/2" X 1 1/4". Ideal for use as a strobe, warning light or attention getter. Complete with instruction on how to wire.
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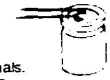

Rubicon CE photoflash capacitor. 0.79" dia. X 1.1" high. These are new capacitors that have been prepped with 1.4" black and red wire leads soldered to the terminals.
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CIRCLE 194 ON READER SERVICE CARD

73 Review

by Dick Goodman WA3USG

SWISSLOG Version 3.66

A complete QSO tracking system in one fast software program.

Frank Greenhalgh KD2LL
10 Robbins Ave.
Amityville NY 11701
Tel. (516) 598-0011
Price Class: $75

Computer logging programs have certainly proliferated in the last 10 years. Until I found Swisslog, I never really deemed them exciting enough to explore in detail. Over the course of the last 20 years I have maintained my log in a variety of ways. During the pre-computer era of the early 1970s, I used the official ARRL logbooks. They worked out pretty well. They had all the necessary fields for mandatory information, such as call, date, time, signal report, etc. The back side of each page was blank, making it excellent for free-form remarks. The only problem was that after the log contained about 200–300 entries there was no efficient way to look up a particular QSO unless you knew the date. So I went to 3" x 5" cards for a while (one for each QSO). What a pain!

Eventually I switched over to an MSDOS machine and tried a variety of commercial logging programs, but none quite suited my needs. I ended up using "DBASE III Plus" as a development system, and finally "Clipper" (a DBASE program code compiler) to write my own logging program. You can spend hours programming up your own system or make it easy on yourself and get a copy of SWISSLOG.

More Than Just Logging

SWISSLOG is not just another logging program. It is a complete amateur radio QSO tracking system with its own versatile reports generator/formatter, statistics generator, worldwide prefix/call library, beam heading routine, grid locator, awards tracking system, propagation prediction program (with graphic display of signal path), Grayline program, and other features too numerous to mention. SWISSLOG can be used as a full-featured logging program by the novice computer user, but its features really shine when the user has rudimentary computer skills.

The documentation provided with SWISSLOG is just about the best I have ever seen. Version 3.66 comes with a 102-page, professionally-bound reference manual, plus a 33-page addendum. It is clear, concise and includes beautifully printed screen dumps and screen layouts. It is written to be a tutorial as well as a reference manual. There are also tutorial files included with the SWISSLOG program itself. This documentation, along with "READ.ME" files, will enable new computer users to come online with this program very quickly. Users who have had generic query language programming experience (e.g. reports generator in DBASE III) will find this program almost intuitive. The ability to sort on any field and generate your own record selection criteria based on any combination of fields is quite impressive.

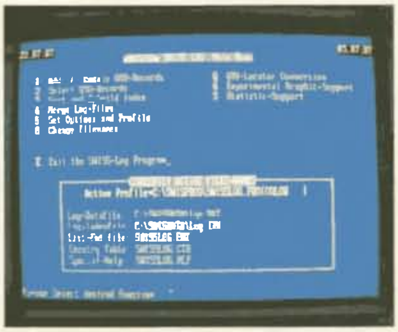


Photo A. The SWISSLOG main menu.

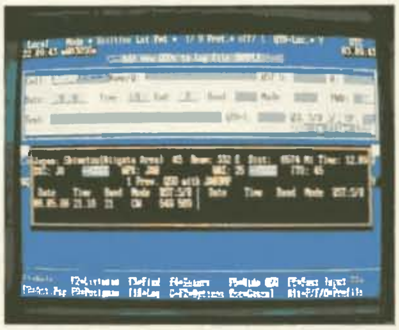


Photo B. Menu for Option 1, "add/update QSO records."

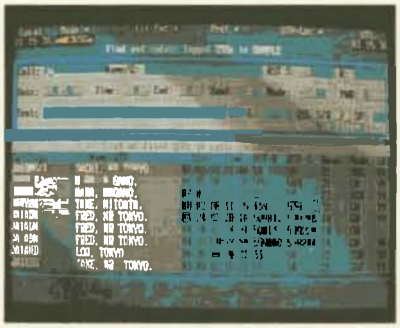


Photo C. Sequential list of all "JA" contacts currently logged.

SWISSLOG is also quite fast. Included on the distribution diskettes is a sample log which contains over 1,200 entries. It took a maximum of about 15 seconds to sequentially search through this entire database and generate on-screen reports from my specified record selection criteria. It should also be noted that SWISSLOG uses index files to control the sorting of the database. Even when the total database becomes much larger than the current 1,200-plus entry size, the time to sort by callsign will not increase once the index file has been built. This was a great limitation on older and less sophisticated logging systems. Another advantage is that an index file takes up much less space then a duplicate data file sorted in the desired sequence. Using index files also makes field seeks (e.g. finding QSOs by callsign) effectively instantaneous.

The reference manual clearly documents installation of SWISSLOG. The installation is totally automatic and takes about five minutes. SWISSLOG requires 512K of memory, and it will run on monochrome or color systems with DOS version 3.1 or higher. I would recommend a hard drive, but a system with two floppy drives will handle up to 2,000 QSOs. This review was conducted on a Comp-U-Add 286 running at 20 MHz with a

Photo D. Progation prediction map.

VGA display. The default color configuration for all SWISSLOG screens is, in my opinion, striking! The color scheme can also be changed by the user. Liberal use is made of pop-up windows. Virtually the entire program is menu driven. To enter the system, simply type "SWISSLOG" and press ENTER>.

SWISSLOG's Offerings

The first time SWISSLOG is executed, the user will be prompted to enter a "personal profile." This consists of the latitude and longitude of the QTH, the offset to UTC, display type (color/mono), and several other parameters unique to the user. This is all requested via a friendly menuing system and only has to be done upon initial program installation. Any of these values may be changed later if desired. The SWISSLOG main menu will follow, as shown in Photo A.

Please keep in mind that because of the sophistication of this program, this review will cover only the main points. The capabilities and versatility of this system are limited only by the imagination of the user.

Option 1, "Add/Update QSO Records," is almost self-explanatory. Upon selecting this option, the user is presented with a menu similar to that shown in Photo B. From here you may enter new QSO data or, by using the appropriate function key as identified on the bottom of the screen, call up existing logged entries to be viewed and edited. Index files are used so the search is instantaneous, regardless of the database size. The order of data entry on this screen may be changed from Option 5 on the main menu to best suit the user's needs. For example, the callsign may be prompted for first, followed by the date and start time, then signal reports and other applicable fields. There is also a contest mode that checks for dupes on each band and notifies the user with inverse video and an audible signal. A sequence number can be kept updated for each QSO for contests that require it. Finally, the propagation prediction feature may be called up from here. This displays a world map with the propagation path displayed, and estimated signal strength on each available band (See Photo D).

Option 2, "Select QSO-Records," presents a sub-menu. This allows the user to select QSO records via the SWISSLOG query language, sort records in any sequence, print, list to the screen or a file those selected records, and browse/update the selected records. Fields selected by the user may also be globally updated or deleted. Additional log files may also be created from this selected data. Reports generated may be formatted as desired.

Option 3, "Sort and Rebuild Index," allows the regeneration of the SWISSLOG index file in callsign sequence. The "Sort" function will physically move the actual QSO records in any sequence of your choice.

Option 4, "Merge Log-Files," allows the user to add the QSO records of one log file to the currently active log. This function enables several log files to be used in parallel, and is particularly useful in contests where a unique file would be required for dupe checking, etc.

Option 5, "Set Options and Profile," allows the user to customize SWISSLOG. Names of files that are to be used, data relevant to your station (e.g. lat, long), definition of the most used options, input sequence of QSO fields, initial values of each QSO record, printer control sequences, display mask attributes, and QSO entry window size and placement may be specified. The color scheme of all SWISSLOG screens may also be modified from this option.

Option 6, "Change Filenames," allows the selection of the active log from all available log files.

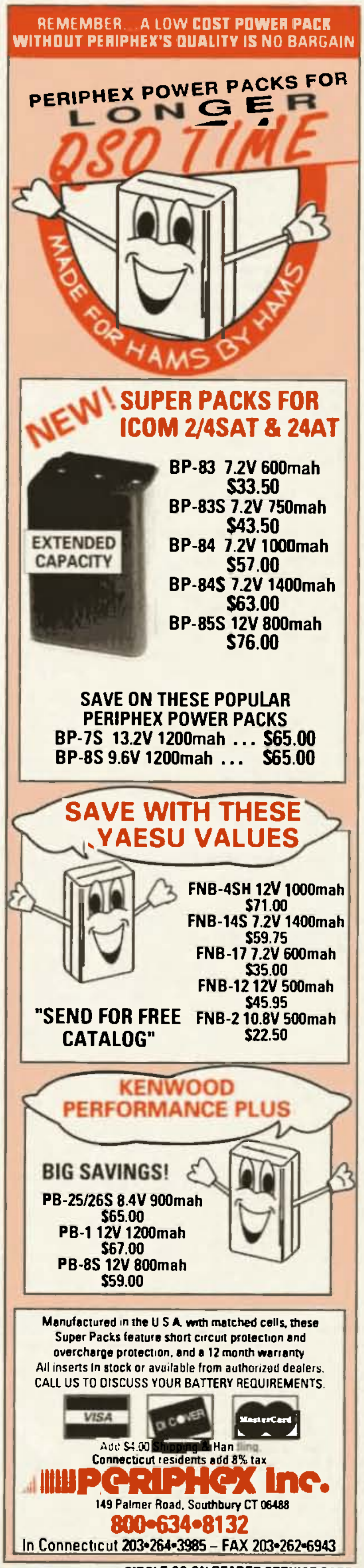
Option Q, "QTH-Locator Conversion," will convert from latitude and longitude to grid square, or vice versa. It also provides beam headings and distance from your station.

Option G, "Experimental Graphic-Support," allows tailoring of station and environmental parameters, such as antenna type and height (for each band) and sunspot number. This is used with the propagation prediction feature.

Option S, "Statistic-Support," generates reports on the user's progress on getting DXCC, WAZ, ITU and WPX awards. These reports are beautifully formatted and would be of great assistance to the devoted contester.

SWISSLOG has numerous other features not touched upon in this review. One important capability is the ability to import ASCII data into the database. This makes it possible to transfer data from other logging programs, or programs such as DBASE III, into SWISSLOG. The table which contains country/prefix/geographical coordinates may also be updated as prefixes or other related data changes. Finally, SWISSLOG may be made resident and popped up from within other programs. The configuration options of this feature are diverse and should satisfy most applications where memory allocation could be a problem.

It is impossible to describe the capabilities of SWISSLOG in the space allocated here. I can say with absolutely no reservations that this is the best logging program that I have ever seen, and I am now using SWISSLOG myself! 73



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Get on the WARC Bandwagon

You can still enjoy good DXing, even as propagation conditions decline.

by Drayton Cooper N4LBJ

Even though Sunspot Cycle 22 has shown some marked idiosyncracies lately, the consensus of opinion is that the number of spots will soon be showing a marked decrease once again. To any avid user of our higher frequency bands (20 meters and above), that means declining conditions on long-haul paths, and increasing frustration over the scarcity of good openings to faraway places. Looking ahead two or three years to the bottoming out of Cycle 22, there is a ray of hope for those of us who enjoy DXing: The WARC bands are now all in place, and one of them in particular should ease the need for a DX fix.

The WARC Bands

The WARC bands are the "new" bands, assigned to amateur radio as a result of the last World Administrative Radio Conference, in 1979. These relatively small slices of spectrum space were handed to us over a period of 10 years, with the last one, 17 meters, opened for U.S. operators less than two years ago.

For the first time in our history, we will be facing the bottom of a sunspot cycle with more choices of frequencies than we have ever enjoyed before. If you have not tried the WARC bands (and there is a surprisingly large number of hams who haven't), this article will introduce you to them. And, along the way, even hams familiar with these frequencies will find a few tips for better using them.

30 Meters

The granddaddy of the WARC bands is 30 meters. It's an all-digital band, meaning that you dyed-in-the-wool CW fans have a home now, just as you did years ago when 40 meters was King of the Air.

The 30 meter band runs from 10.100 MHz to 10.150 MHz, and in that 50 kHz you'll hear nothing but CW, AMTOR, RTTY and HF packet since, with few exceptions, voice modes are not allowed in this band.

Clustered near the lower end of 30 are the CW operators. If you're not the holder of a 35 wpm code proficiency certificate, don't feel that there's no place for you on 30. The vast majority of fists you'll hear on the lower end of 30 are sending at a comfortable rate of

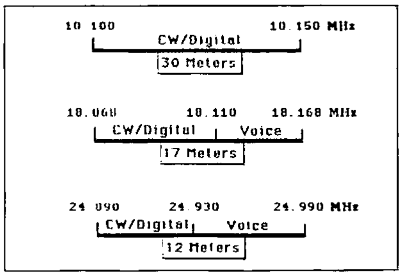

Figure. Frequency chart of the WARC bands.

15–20 words per minute.

The propagation on 30 is not necessarily what you would expect it to be. Many hams felt it would combine the best of 20 and 40, and to a degree it does.

One of the charms of 30 meter operation is that it can exhibit some very unexpected surprises. For instance, you may be rag-chewing with a friend in the 350-mile range, sign with him, and suddenly hear a station calling you from another continent!

DX possibilities are generally quite good on 30. One reason for this is that all hams are on fairly level ground on this band as far as power is concerned. Most countries have set limitations on power output on 30m (250 watts is generally the maximum), and antennas on this band continue to be primarily fairly simple ones.

12 Meters

The next WARC band to be opened to U.S. hams was 12 meters. Nestled about halfway between the very popular 15 meters and the quixotic 10 meters, 12 meters runs from 24.890 to 24.990 MHz. The mode plan on 12 divides the band at 24.930 MHz: Below that point, communication is limited to the digital emissions; above it, SSB reigns supreme.

If you're a DXer trying this band for the first time, look for stations around 24.935 on SSB. In the early days of 12 meters, many DXers settled in a few kHz up from the lower SSB band edge and, out of habit, they continued to center in this area.

On CW, however, it seems that there is no fixed DX window. Both stateside and foreign stations are found throughout the lower portion of the band.

Propagation on 12 meters seems to be much more like 10 meters than 15. This means that the band is often apparently dead, with few, if any, signals coming through. However, there might be plenty of ionospheric support for communications if someone would put out a CQ.

The 12 meter band does seem to be underoccupied. There was an initial rush of stations trying it out, but now the number of operators using it seems to have leveled off considerably, so there is practically no QRM.

Because of its proximity to 10 meters in the radio spectrum, conditions on 12 are often a "delayed" mirror of 10. For instance, from the East Coast, operators on 10 meters look west late in the afternoon for contacts with Oceania.

Sometimes, just as a rare Pacific island becomes readable in the east on 10, the band folds, and the station is lost. Dropping down to 12 meters at this time, the East Coast ham would still be able to hear signals from the same general area that he had on 10. However, because 12 meters is principally a daytime band like 10, he might get only another 30–60 minutes of use before it, too, closed down.

17 Meters

The "sleeper" in the WARC bands appears to be 17 meters. More and more, this band seems to be catching on with hams around the world. Band occupancy on 17 is now quite good, and QRM is becoming an everyday occurrence.

This band runs between 18.068 MHz and 18.168 MHz, with the dividing point between CW and SSB (in the United States, at least) at 18.110 MHz. Above that point, SSB is permitted; below it, the digital modes are exclusive.

There is no reduced power limitation on 17 (nor on 12, for that matter), and if you want to run the legal limit, you may. However, few stations on 17 run much more than 100–200 watts. In all likelihood, though, this is not because of any altruistic motivation! Until quite recently, most commercially available linear amplifiers either would not resonate on 17 meters, or would do so only very inefficiently. As the manufacturers redesign their gear to load up on 17, you can expect more

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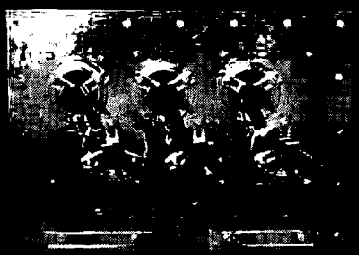

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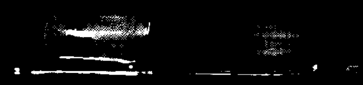

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and more high power stations to appear there.

If you listen on 17, you are in for some real propagational surprises. One day the band may be filled with signals from both the United States and Europe; a few hours later, signals from half a world away may be the only ones you hear!

Just recently, the USSR Antarctic station, 4K1B, was heard here on the East Coast at 579–599 levels, while only a few kHz away the USSR Arctic counterpart, 4K2OIL, on Franz Josef Land, was coming through at equally good signal strengths. These stations were almost 12,000 miles apart, yet both were being worked by hams across the United States.

Another eye-opener on 17 is the strength of long-path signals. Stations in Australia and New Zealand generally come through on the short-path (i.e., direct path) into the United States during the early morning hours on 17 meters.

Later in the day, however, you can often work these same VK/ZL stations with even better results by using the long-path. The same phenomenon appears on 20 meters, at generally the same hours, but the long-path signals on 17 usually seem stronger than they do on 20.

DXing

Thus far, the IARU (International Amateur Radio Union) has banned contest operations on all three of the WARC bands. For those hams who do not care to engage in the RF mayhem of contesting, the WARC bands offer a respite on those winter weekends when it appears that the rest of the world's population is sending nothing but "CQ Test."

Little by little, however, DXpeditions are discovering the new bands, particularly 17 meters. This is a knife that cuts both ways. The presence of some of the more recent DXpeditions on 17 has allowed many hams to have a taste of working a really rare one. In some cases, the appearance of the expeditions on the WARC bands gave many an opportunity to work the DX they would not have had on the other bands because the pile-ups were smaller, and were far more disciplined.

This brings up another point about the WARC bands. Much of the raucous and discourteous operating habits found in such abundance on the established bands is generally nonexistent on the WARC frequencies, even in the midst of DX openings. Why this is the case would be a good topic for a sociologist or psychologist to explore. But so far, the vitriol and hostility which have marred our reputation around the world is simply absent on the WARC bands.

Antennas

For many (probably most) hams, the antennas of choice for the WARC bands seem to be the ones they already have! However, some time spent on putting up a good antenna for 30, 17 and 12 will pay off in huge dividends.

In preparation for writing this article, I recently spent several hours on 17 meters, listing the various antennas I heard in use. Far and away, the most-used antenna appeared to be either a 75 meter or 40 meter center-fed Zepp. Not far behind came the G5RV variation on the same theme, followed by loops of various configurations. Only a very few stations seemed to be using resonant, multi-element, rotatable antennas. The ones who were using them, though, "owned" their frequencies!

I expect my experiences with antennas for the WARC bands are typical. When I first used these bands, I loaded my "all-band Zepp" on 30 meters with a T-match tuner. The results were good, and I was satisfied. Then I heard a W8 who was using the same rig I was, but was feeding it into a 2-element rotary. He and I often worked the same DX stations back-to-back, but he usually got a 589 or 599 from the DX station, compared to my 569. Lesson learned!

A compromise antenna will work well on the WARC bands, but a dedicated, resonant antenna will work far better. There are several dual-band yagis now available commercially for 17 and 12. I can highly recommend the 2-element 12/17 beam available in kit form from Gary Nichols KD9SV, owner of SV Products, 4100 Fahlsing Rd., Woodburn IN 46797; but there are others available on the market that are probably just as good. Cushcraft now produces 3-element trapped 12/17 beams and monobanders for the WARC bands. Also, a number of manufacturers offer WARC add-on kits for their existing antennas.

Rolling your own for the WARC bands, especially for 17 or 12, would be a worthwhile project, too. Boom lengths are certainly reasonable (mine is only 8') and aluminum tubing for the elements can be found in most hardware stores. And, there is certainly no reason not to use "thin wall" conduit (EMT tubing), which was the staple item for years for nearly all home-brewed beams of earlier times.

There have been several articles published in the amateur literature on yagi designs for 12 and 17 meters. One of the best of these appeared in the July 89 issue of *Radio Communication* (the journal of the Radio Society of Great Britain). This design uses three elements on a fairly short boom, with a split driven element. The advantage to this type of construction is that the driven element can be fed directly with the coax, so you won't need to build a gamma matching device.

I hope that this primer on WARC bands has piqued your curiosity, and that you'll be interested enough to give the new bands a try. As I've pointed out, each of them has its own appeal, especially as we look at deteriorating propagation on the established bands, and the increasing QRM as more and more stations "move down" because of the decline in sunspot activity. A good antenna for the WARC bands is in reach of every ham, and with one, you'll find a new world of operating pleasure awaiting you.

Why not hop on the WARC bandwagon now? 73

Contact Drayton Cooper N4LBJ at P.O. Box 5, Bowling Green SC 29703.

Number 16 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton CA 92633

Hunting for the Gold

"This Time It's Our Turn!" That's the headline of the bulletin I received, describing what will probably be the first international amateur radio direction finding (DF) competition on US soil. It may also be a prelude to T-hunting becoming an event at the Olympics!

The bulletin was from the Friendship Amateur Radio Society (FARS). It came with a lengthy letter from John White K7RUN. I hurried to the phone and was soon speaking with him. The good news was that the upcoming contest was "for real." The bad news: There was little time to round up our best "world-class" DFers.

Sister Cities Starts It

Portland, Oregon, is a sister city to Khabarovsk, in Asian USSR. Khabarovsk has 650,000 residents and is 480 miles northwest of Sapporo, Japan. In the spring of 1989, the Portland Amateur Radio Club (PARC) was invited to send a team to the first Sister Cities Friendship Radiosport Games (SCFRG-89) in Khabarovsk, to begin September 25 of that year. The Soviets would have two teams competing. There would also be a team from Niigata, Japan, another sister city to Khabarovsk.

PARC was up to the challenge, and sent five locals to the Games. They were: Richard Fredrickson WAØDIM (Photo A), Dave Wright N7MYO, Kevin Hunt WA7VTD, John White K7RUN, and Rene Berblinger KX7Z.

In addition to the foxhunt, the Games included high speed CW and HF "round robin" DX events.

In the USA, we think of a T-hunt as an outing in the family car, van, or jeep, with perhaps a hundred feet of "sniffing" at the end.

Elsewhere in the world, however, the fox is a completely different "animal." In Europe and the Far East, foxhunting is an athletic event. Successful competitors are skilled at DFing and wilderness orienteering, plus they can withstand the rigors of a course that may take them several miles.

The PARC participants knew little of what lay ahead. They knew nothing about the DF gear they would be using to find the fox, because it was to be supplied to all the teams by the Soviet hosts. Talk about a home-court advantage!

Foxhunting, Soviet Style

There are no "appliance operators" in the USSR, because no commercial ham gear is made there. Russian hams "roll their own" or convert surplus military rigs. Evgeny Stavicky UWØCA, Chairman of the Khabarovsk Territorial Radiosport Federation (Photo B), built his own state-of-the-art HF transceiver, complete with LED readout, from salvaged parts. The Soviets cannot buy ham and DF gear from the US and Japan because the ruble is not an international currency.

K7RUN described his introduction to Soviet-style foxhunting: "The DF receivers were the only piece of manufactured ham equipment I saw in the whole stay there. They were quasi-military devices, with no S-meter. You had to listen in the earphones and judge the signal strength.

"The foxhunt was held on two meters. They have very little activity on that band in general there—no repeaters. Antennas were all four-element yagis, with a bit of a strange pattern. They were built to be collapsible. The elements were curved steel like a tape measure, which held shape when extended but could be folded up.

"The target transmitters put out MCW. The receiver was not a superhet design. It was the TRF type, solid-state, broad, and very difficult to tune. There was no BFO, but it had a quencher circuit that interrupted the received signal at an audio rate to create a tone.

"The five DF units for our team were not very uniform. The antennas tended to have two nulls on the back, one much deeper than the other."

As Murphy would have it, the day of the DF competition was the only day of rainy weather during the team's stay in Khabarovsk. "We all had the look of drowned rats," says K7RUN. By world radiosport standards, the event was held on an abbreviated course, with only three transmitters.

The total course was about a mile. The Soviet teams placed first and second, as expected. The PARC team came in third, followed closely by the team from Japan. Shortest individual time for the course was just under five minutes. Longest time was 44 minutes.

After the Games ended, there were visits to the homes of Soviet hams, a group boat ride on the Amur River, picnicking, and hours of happy ham and non-ham talk. Just as in the USA, hams in the USSR are a cross section of the country. UWØCA is a professor of music and a piano teacher in a girls' school by day. He runs a club ham station for his school.

The US hams were given Soviet ham tickets upon arrival. Some of the Russians wanted to get operating privileges for future visits to the USA. There were enough VEs in the US delegation to hold an exam session in Khabarovsk, but the exams had to be given in English. Nevertheless, Mikhail Zavarukhin UWØCN passed all the elements for his US Extra class license and is now AA7CH.

Photo A. Cameras flash as Dick Fredrickson WAØDIM leaves the foxhunt starting ramp at the first Sister Cities Friendship Radiosport Games in 1989.

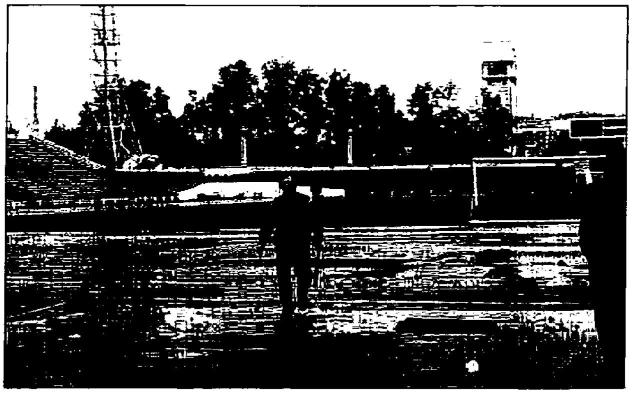

Photo B. Piano teacher Evgeny Stavicky UWØCA sprints to the finish line after completing the foxhunt course in Khabarovsk, USSR.

Let's Have a Rematch

Soon it was time to go home. But the hams of Portland were not about to let it end there. They soon established FARS, a nonprofit corporation, in November 1989. A few months later, UWØCA and UWØCN visited Portland to help promote FARS, plan further events, and demonstrate radiosports (non-DF) in the Goodwill Games. Evgeny passed his Technician exam during his time in the USA.

That brings us to the present, and the Friendship Radio Games of 1991 (FRG-91). Under the leadership of WAØDIM, FARS is putting on a three-ring circus of ham radio competition beginning May 30: foxhunting, CW sending/receiving, and HF contesting.

The FRG-91 DF contest is being held in Forest Park, said to be the largest park in any city in the world. In keeping with world-class European competition rules, five hidden transmitters will be scattered around the park. Each contestant's score will be his or her time to find the five rigs, in order, and return to the starting point.

Transmitters will have CW identifiers, and be activated in sequence for one minute each. In addition, there will be a continuous homing transmitter on a separate frequency to guide the contestants back to the start/finish line. The complete course will be 3.75 miles or less.

FARS is providing DF equipment to entrants selected for the team competition. A limited number of individuals will be allowed to compete independently, but they must provide their own gear. Maps of the course will be provided in advance.

As you might expect, the Portland area will provide most of the US foxhunters for FRG-91, but the organizers want other areas of the country to be represented, too.

As of this writing, it looks like Albuquerque, New Mexico, and the Los Angeles area will be represented, at least.

The Soviets and Japanese will be present again, of course. A dozen hams from Khabarovsk will be there, along with Gene Shulgin UZ3AU, technical editor of *Radio*, a Soviet ham magazine. In addition, a team from Vancouver, Canada, may compete.

Foxhunting at the Olympics?

FARS has even bigger ideas for the future. K7RUN says, "We are pushing, as is Eastern Europe and the USSR, to make foxhunting an Olympic sport, at least as a demonstration. A set of games is being planned for Leningrad in several months that will be used as a springboard for this."

Hats off to the hams of Portland for bringing world-class woodland foxhunting to the USA! Watch future "Homing In" columns for the results of FRG-91. For more information about FARS and FRG-91, write to PO Box 13344, Portland OR 97213. 73

Number 17 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Station Enhancement

Only 15 years ago most of the antennas and accessories in an amateur satellite station were home-brew or made from kits. Today the reverse is true. All the necessary gear can be purchased, but many amateurs prefer to build their own preamp and antenna-polarization control box.

Some satellite antennas come with polarization-control units, or can be purchased as an option. A few mast-mounted preamps come with control boxes, but most do not. In many cases, stations will have at least four individual control units for the antenna-mounted 2 meter and 70 cm preamps and the polarization relays on the antennas.

Newcomers may ask why mast-mounted preamps and polarization-control devices are necessary. Sometimes they are not, but amateurs who have worked with the satellites for a few years know the advantages of having them. Such systems are especially useful for the high-orbit satellites, like AMSAT-OSCAR-10 and AMSAT-OSCAR-13, where distances and signal attenuation are many times greater than for the low-orbit satellites.

The schematic in Figure 1 shows a simple control box that incorporates all the necessary control functions with the least number of parts. Most polarization relays and remote preamps operate from 12–14 volts DC, so any 12 VDC regulated supply capable of one to two amps will provide power. If the supply is home-brew, install a fuse with the appropriate current rating on the AC line. Commercial supplies should already have a fuse.

The purpose of the simple design is to give an easy-to-read and meaningful indication of relay or preamp operation. The first LED after the power supply is simply a power-on indicator, while the second shows that the 12 VDC in-line fuse is intact. The current meter provides the simplest means of monitoring the relays and preamps with a true indication that the correct current is being consumed by the device or devices that have been activated.

Most polarization relays draw about 100 mA. When a line is energized, the expected reading should show on the meter without change. Loose connections are immediately apparent if the reading varies. A short causes spikes and may even blow the fuse, but no power supply damage occurs and the problem can be quickly resolved by tracing the line to the antenna. Corrosion over a period of years is usually the problem.

Mast-mounted preamps can draw as little as 50 mA up to a few hundred mA. Before they are installed, each polarization relay and preamp in use should be tested, and the current measured, to characterize nominal consumption. Labels on the control box for each line are helpful. In a typical configuration with 100 mA polarization relays and 50 mA preamps, the current meter shows 300 mA when all the remote items are activated. The extra line could be used for a 10 meter preamp in the shack.

Cable to the remote relays and units should be good quality rotor cable or old coax runs. Avoid cheap rotor cable—it will deteriorate with outside exposure to the elements. Eight-conductor cable is the best since the extra conductors can be connected in parallel for the ground return. The 1,000 pF capacitors on the control box output lines keep stray RF energy out of the system. A terminal strip on the back of the box provides an easy way to disconnect lines for troubleshooting problems that can develop with time.

My control box has been in operation for over 10 years. In that time, I've installed several different antennas and tried as many preamps. I detected deteriorating cables, isolated faulty relays, and replaced the current consumption labels on the front of the box whenever a new remote device was installed. Of all the hamsat shack accessories, the control box has been one of the most useful.

What Is AMSAT?

Created in 1969, AMSAT is a worldwide organization of amateur radio operators dedicated to educational and ham-related activities via satellite. The goal is to build and support satellites for open use by amateurs everywhere.

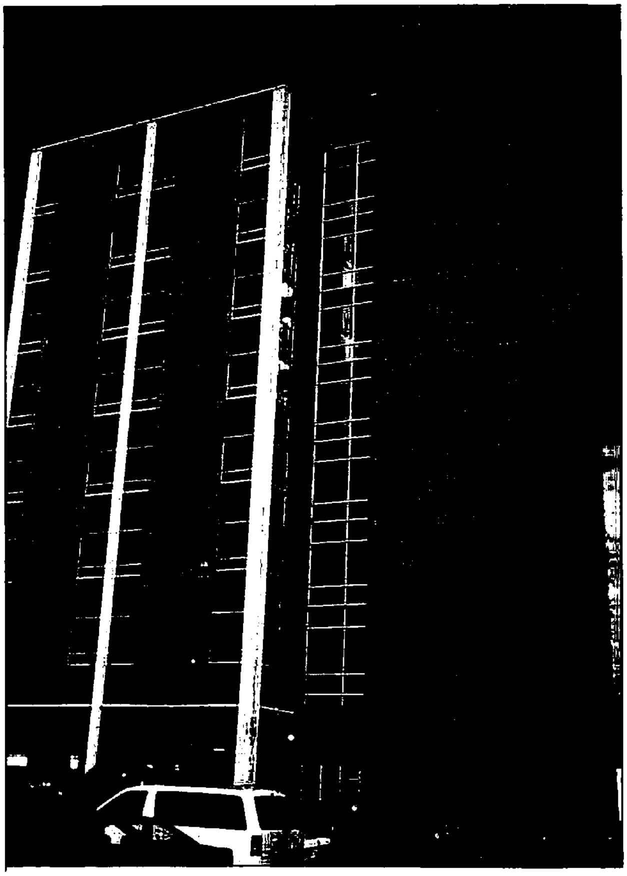

Photo A. AMSAT's main office is here in the Washington, DC, area.

Current operational amateur spacecraft include: AMSAT-OSCAR-10, UoSAT-OSCAR-11, AMSAT-OSCAR-13, UoSAT-OSCAR-14, AMSAT-OSCAR-16, DOVE-OSCAR-17, WEBER-OSCAR-18, LUSAT-OSCAR-19, FUJI-OSCAR-20, AMSAT-OSCAR-21 (also known as RS-14), RS-10/11 and RS-12/13.

Project OSCAR of California began the tradition in 1961 with the launch of OSCAR-1. (OSCAR stands for Orbiting Satellite Carrying Amateur Radio.) In recent years, international AMSAT groups have adopted location designators. For North America, this nonprofit educational organization is called AMSAT-NA.

Photo B. Martha Saragovitz, AMSAT Secretary, takes another call at (301) 589–6062.

Photo C. A Phase 3 Hamsat spaceframe greets visitors as they enter the AMSAT office.

Where is AMSAT?

The easiest way to answer the question, "Where is AMSAT?" is to point skyward to the incredible array of ham satellites.

AMSAT-NA is a volunteer association with very few paid employees. It has offices in Silver Spring, Maryland

Continued on page 58

Number 18 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
Media Mentors, Inc.
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Staten Island NY 10313-0006

Introduction to KF6PJ

There are so many teachers and instructors doing so many innovative and exciting things with amateur radio! Many school teachers and amateur radio instructors have written in to share their ideas with others. In upcoming columns, I'll feature schools where the creative uses of amateur radio are being used in the classroom, and I'll highlight successful recruiting methods used by amateur radio clubs across the country.

In April 1989, I had the pleasure of meeting a teacher, Dave Reeves KF6PJ, and his wife Bernadette, at a NASA Educator's Conference (for the Magellan launch at the Kennedy Space Center) in Orlando, Florida. Dave and I, being fellow hams, immediately found each other. We've been corresponding ever since, exchanging ideas and classroom experiences. It's a personal pleasure for me to showcase the wonderful work he's been doing with amateur radio at the Chaminade College Preparatory School in California. The following is the article Dave prepared with his students for this column.—WB2MGP

High School Club Station WA6BYE

Dave Reeves KF6PJ: Imagine a Space Age high school science classroom at Chaminade College Preparatory in West Hills, California. This week the space shuttle *Columbia* on mission STS-35 is in orbit, carrying the Astro-1 observatory and SAREX (Shuttle Amateur Radio EXperiment). A large TV screen in the classroom displays live video of the earth from the shuttle's payload bay via K6KMN's Mount Wilson ham TV repeater. Another large screen computer terminal displays the location of the space shuttle as it orbits the globe. Several students are studying plots of solar panel currents and temperature data they have just obtained from the DOVE ham satellite.

The students at Chaminade became interested in space science when they participated in the 1985 SAREX experiment and got an SSTV picture from astronaut Tony England WØORE on the space shuttle *Challenger*. With the help of physics teacher Dave Reeves KF6PJ and engineer Mike Tweedy KA6SPT, the students have maintained an ongoing space science program using the OSCAR amateur radio satellites.

Now, Ben DeWit and Keith Butler listen for the first sounds of the packet radio telemetry beacon as DOVE pops above the horizon. Their computers point the satellite antennas and capture today's telemetry data. On the NASA TV, an excited scientist in Huntsville reports data from a distant galaxy showing high energy radiation from matter "waving good-bye" just before being swept into a black hole. Chaminade senior Rima Mulokas looks up from a worksheet on the efficiency of the Microsat solar cell, gazes at the live pictures of earth from the shuttle, and says, "I don't believe this. This is blowing my mind!" Teacher Dave Reeves smiles in agreement.

Articles from *The Los Angeles Times* and *Daily News*, a stack of video tapes with no less than nine network and local TV news reports, and the ARRL SAREX video, tell the story of the past five years of the students' involvement with ham radio in space.

Encounter with Ron Parise WA4SIR

"Star Students—Students Tap Short-Wave for Long-Distance Reach to Shuttle." This *Times* headline reported the latest exciting SAREX event. The physics class, with the help of 11-year-old Jimmy O'Donnell N6VYA, talked with astronaut Ron Parise WA4SIR on the *Columbia*.

Because of the Astro-1 astronomy mission, the shuttle didn't pass over the United States during normal school hours; volunteer relay stations in Brazil and Australia helped out. The morning of our contact, Larry Etter N6MBJ used Frosty Oden N6ENV's "Valley Repeater" to call AMSAT so that we could listen in on Ron and a couple of students. The students were Jim Fonte KK9T in Indiana and Dan Blackburn K5ZCO in Texas. This session was relayed through PY2BJO Junior, in São Paulo, Brazil. Our students listened to the tape of the contact to try to anticipate what their own contact was going to be like.

On the evening of December 4, our students excitedly gathered on the lawn near their classroom to talk to Ron themselves. Adam Wahab used the computer display set up by Anthony Fredericks and Eric Sunde to show the 100 spectators and the press that the shuttle was now coming in over the Indian Ocean, and would soon be within range of the VK6IU tracking station in Western Australia.

Photo A. Eric Sunde, Melissa Parker, and computer group leader Anthony Frederick watch Columbia's *progress on TRACKSAT.*

Photo B. Nicole Newman displays the orbital gyrations of DOVE while John Fenger and Andy Casciato watch attentively. The Astro-1 BBXRT (the "trash can") is on the TV screen.

Photo C. SAREX team Dave Reeves KF6PJ, Jim O'Donnell N6OYF, Melissa Parker, Jimmy O'Donnell N6VYA, Robert Nomura, and Lori Jadon, after making contact with Ron Parise WA4SIR on board Columbia *on December 4, 1990.*

Jimmy O'Donnell accessed the phone number to the "bridge" in West Virginia. Bill Tynan W3XO, at the W5RRR club station at the Johnson Space Flight Center in Houston, was soon on the line. Three other schools also joined the bridge. Allen Miller N7NHM from Rigby Jr. High School in Idaho, Dale Harris WA5OAP from Las Cruces, New Mexico, and Ron Curry WA4GSS from Lawrence County, Kentucky, were checked in and ready. Three relay stations in Australia were clearly heard: Gorden VK6IU in Western Australia; Graham VK5AGR in Adelaide; and Art VK2AS in Sydney.

The shuttle popped above the horizon near the western AMSAT tracking station in Australia, and Ron Parise was ready for Jimmy O'Donnell's question: "If you saw aliens or a UFO, would you try to communicate with them, and if so, how?" Ron replied: "You know, we've been looking out the window for the Soviet space station *Mir*. They're up here with us, too. We have 12 people in orbit right now. They're not exactly a UFO. I don't know what I'd do if I saw a UFO out the window. Probably just wave." Alesia, another student asked: "How far in space can you see?" Ron: "Well, looking out in space we can see to the edge of the universe with our telescopes. That's a long, long way. With your eyes, looking down on the earth, we can see about 800 miles in any direction. We are just coming up across Shark Bay on the western edge of Australia. If I were looking out the window, I could see all the way to Central Australia, and all the way north to Java. We can see a big piece of the earth, and I'll tell you, it's really beautiful from up here."

Andy took the mike next, and asked: "What do you think might be beyond the quasars?" Ron: "That's an interesting question. Maybe we'll be able to shed some light on that with this mission. I'm not sure exactly what quasars are, but they appear to be very early prototypes of galaxies that we see now, but we're seeing them so far back in time because they're so far away. Their light took a long time to get here. And before that, before the beginning of the universe, we're not sure what happened."

At this point, Ron was passed to Wess VK5AGR in Adelaide. Wess asked: "How many stars can you see from orbit that are not visible from earth?" Ron: "It's not that we can see more stars, but that we can see ultra-violet light. UV light gets filtered out by the atmosphere, and we can't see it from the ground. So that's what's important to us here with these telescopes." Ron said that it is hard to see

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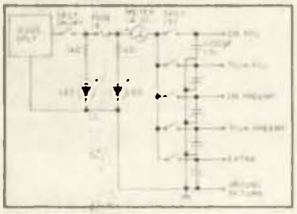

Figure 1. OSCAR antenna polarization and external preamp control

on the north side of Washington, DC and Paris, Texas, northwest of Dallas, but the satellite construction and support programs are active wherever AMSAT volunteers live

There is no well-defined central point for satellite work, although activity can always be found in the vicinity of AMSAT Vice President of Engineering Jan King W3GEY. Jan presently lives in the Boulder, Colorado, area

A visit to the modest AMSAT office in Silver Spring, Maryland, hints at the broad activities of the organization. Here is where memberships and software orders are processed A visitor can find satellite drawings, correspondence, and models dating back to the early days of the organization.

Several of the original organizers of AMSAT live within a few hundred miles of Washington, DC, but over the years members of the Board of Directors have come from most points within the U.S., as well as from Canada, England and Japan Today's board members are from Colorado, Maryland, Michigan, New Jersey and Texas.

The success of this organization, with a satellite program that many governments cannot match, is due to the passionate dedication of the membership. The AMSAT field organization has over 130 Area Coordinators and Regional Coordinators around the country who volunteer their time to answer questions, give talks and present demonstrations at hamfests. Their "pay" is the satisfaction of helping others enter a truly remarkable facet of the amateur radio hobby.

So, the next time you're asked "what" or "where" is AMSAT, just point up 73

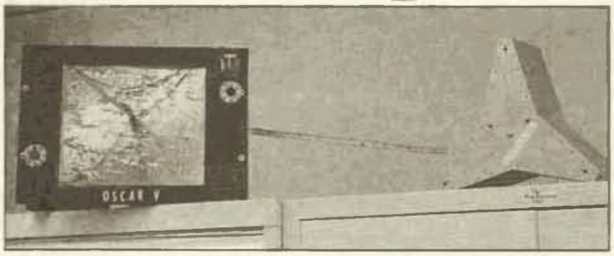

Photo D. A model of AMSAT-OSCAR-5 sits quietly on an office cabinet.

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 Continued from page 56

stars out the window with the lights on inside the shuttle.

Next, Michael in Dale Harris' group in Las Cruces, New Mexico, asked: "What are the benefits of the UV Telescope you are taking up, compared to the Hubble?" Ron explained that the Astro-1 UV has a wider field of view and a broader spectrum range than the Hubble. Heather, also in the group, asked: "What kind of emergency methods do you use in case of danger, such as lack of oxygen?" Ron said that even if a small hole were to be punctured in the shuttle, they would be able to maintain their oxygen supply long enough to get safely back to earth.

By now, control had been passed to VK2AS in Sydney, and Brian, in Ron Curry's group, asked the last question: "What do you expect to find concerning the super nova of 1987?" We are not sure of Ron's answer because our recorder ran out of tape at this point Even so, the astronomy lesson and the SAREX contact were a smashing success for amateur radio!

There were lots of little problems during the contact. Signals were lost at both ends several times. We missed an important "over" and doubled with Ron, as our radio had accidentally been switched to low power, and our audio was scratchy into the repeater Several other schools had trouble with audio feedback into the radio, and the keys on touch-tone got pushed once or twice. Once, Ron lost his footing and floated away from the radio for a moment. Yet the communication was exciting, and every school got a chance to speak with Ron. Many other repeaters across the country were able to call in, listen to the contact, and share it with hams interested in SAREX.

SAREX has brought space science alive at Chaminade College Preparatory and in many other schools across the country. Amateur radio can help capture the imagination of the new generation. There is no doubt that we will one day be using ham radios to talk to astronauts on the space station *Freedom*, the moon, Mars, and beyond!

Twenty-Five Years!

This brief description of the classroom events of the past week illustrate the benefits of getting teachers, kids, and schools involved in ham radio. For my students and me, ham radio has always played an important role. Our Chaminade High School Club Station, WA6BYE, has been on the air for 25 years.

The club's two stations use almost every mode and band available: HF, VHF, RTTY, SSTV, ATV, satellite, and packet. Mike Tweedy KA6SPT designed and built the club a computer-controlled satellite antenna rotor system. Our 105-foot HF tower can be seen for several miles

My students and I have shared many memorable ham radio experiences. We have worked the entire globe on 20, 15, and 10 meter DX, worked military phone patch traffic during the Vietnam War, and emergency traffic during the Mexico City earthquake. We have been a Scout-o-Rama event station. We have worked with OSCARs-8/10/12/13/17/19 and RS-10/11. We've talked with students in Carole Perry and Joe Fairclough's classrooms in New York City.

Our most thrilling experiences have been the 1985 SAREX, when we obtained a great SSTV picture of Tony England W0ORE, and our 1990 SAREX conversation with Ron Parise WA4SIR.

Microsat—An Ongoing Experiment

With the launch of the four Microsat satellites, we had the opportunity to fully integrate ham radio into our physics classes. I asked Maria El-Zik, a senior in the physics class, to explain how the project works

Maria El-Zik: "I am one of the seniors currently involved in a new experiment. We are tracking the Microsat satellites which have been orbiting the earth for about a year. We are currently focusing on DOVE, the most attainable and readable of the four Microsats. All the students in Dave Reeves' two physics classes have specific jobs related to tracking DOVE.

"Today, for example, the people in charge of predictions were at work first. They were in the lab early this morning in order to learn DOVE's passing times for today. This was done with two computer programs: TRACKSAT and ORBS. Then they charted the passing times on the blackboard in our physics room.

"The operators were at work next. People like Ben DeWit and Keith Butler track DOVE on the receiver during lunch. They obtained 15 pages of data from the pass today, a good average. Soon other operators will be tracking an evening pass.

"Joe Hafferty and Paul Brukiewa created a full-scale model of DOVE, complete with antennas that are white on one side, black on the other (made so the satellite rotates with the sun's natural power).

"The next group is vital to our experiment They give meaning to the data obtained by the operators by analyzing it and plotting it on graphs. They do all this by using computers. This takes quite a while, but the results are impressive We have been able to analyze DOVE's movements by studying their graphs. We would also like to learn something more about the greenhouse effect by comparing the infrared readings taken above land to those out on the ocean. We are all extremely interested in the result of the analysis because we believe the greenhouse effect is the major ecological problem of our day

"Finally, it is our turn. As the public relations group, we write to various places, either obtaining information about the Microsats or telling the scientific community what we are doing.

"All of us enjoy tracking DOVE. It is so much more meaningful to learn physics in this way. And we are not only learning the standard science, we are learning about computers, data analysis, and writing skills. This is an experiment we will all remember for a long time." 73

RTTY LOOP

Amateur Radio Teletype

Number 19 on your Feedback card

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Portable RTTY

With the approach of Field Day, I sat back and reflected on just how that impacts on RTTY. On the surface, I get this mental image of a Model 15 in a sedan chair, being transported to the wilds of the outback. When Field Day was conceived, that was *exactly* what portable RTTY was all about, unless you had a Mighty-Mite or the like. But not today!

Sure, the hardy among us might still lug along a conventional teleprinter, and there are those well-equipped clubs with vans sporting every conceivable mode of communication; but how about the ham wishing to operate on a digital mode without breaking his back?

For the purposes of this discussion, I would rather not concern myself with the transmitter, receiver, or antenna. Somehow I have confidence that these topics are adequately covered elsewhere in this magazine. Let's just direct our attention to the RTTY end of the table. To this end, I would like to examine:

- RTTY interfaces and terminal units
- Keyboard and control units
- Printer and hard copy devices

Decoding the RTTY Signal

Compared to the old tube-type terminal units that were popular when I started in RTTY, the RTTY/packet modems currently represented are marvels of miniaturization and power conservation. Sophisticated controllers, such as the AEA PK-232 and Kantronics KAM, are small enough to pack along, and will run on the same power supply as the radio.

For those who choose to roll their own, TNC or demodulator boards are available from a variety of sources, as well as some schematics presented in this column in the past, which would enable construction of a compact RTTY terminal unit.

Those whose intent is packet operations only, and who are in search of the ultimate in compactness, might do well to look at the Heath HK-21. This little marvel allows packet operation with a TNC about four by three inches, small enough to fit in a shirt pocket.

Packing the Keyboard

Here we have quite a variety of materials to choose from, but our latitude depends on one critical factor: the availability of AC power. If the portable station is run on conventional AC power, either from a generator or the utility company, available input/control devices range from dedicated RTTY terminals to power users' bit crunchers.

Considering space and weight, a case could be made for some of the simple, all-in-one style computers. Such widely used, inexpensive, compact devices as the Color Computer, Commodore C-64, and the like can make excellent interfaces, especially with a smart terminal unit providing much of the logic related to digital communication.

Where freedom from AC power is a must, notebook computers shine. While I have yet to caress one with my own hands, one hot computer in this market, by many experts' accounts, is marketed under three designations: the CompuAdd Companion, the Sharp PC-6220, and the Texas Instruments TravelMate 2000. A 80286 running al 12 MHz, with 1 meg of RAM, a 20 MB hard disk, and a VGA resolution LCD screen, this little wonder comes in under $3,000, a remarkable price. And at 4.3 pounds, and the same size as a sheet of bond paper, not too much to carry, either.

I might also mention the Zeos Notebook, a similar bargain. If you have access to an 8088 based portable, and want to use it, fine! But I, for one, might caution against investing in one at this time, with all the new technology on the horizon—and even in the foreground.

Hard Copy, Anyone?

Once again, let's put the big page printers, and even conventional computer printers, aside. Portable printers are available, and if you want one, quite a few will fill the bill.

Canon's BJ-10e is an ink jet that produces near laser quality print from a notebook sized box. Priced under $500, this four pound wonder comes with battery or AC power options, as well as a cut-sheet feeder.

For about the same money, Eastman Kodak produces the Diconix 150 Plus, which handles sheet or fanfold stock, in a compact 10.8" x 6.5" x 2" package. With a weight under four pounds, including batteries, it's hard to resist.

One other option to pack into your bonnet: There are several programs around which redirect all printer output to a disk file. With a big enough hard drive, such a program can provide a record equivalent to paper, without the need to carry around boxes of the stuff, plus a printer.

Tip Department

So, while you're doing all this setting up and the like, wouldn't you like a simple little tone generator for testing the setup? Well, if you have a PC type computer, and BASIC, you have an RY generator.

James Kretzschmar, DDS, N4HCJ, sent along this short little program which uses the BASIC SOUND statement to produce tones needed for alignment. The program, which may be entered into GW-BASIC or BASICA is:

```
10 FOR X = 1 TO 200
20 SOUND 2125,.5
30 SOUND 2550,.5
40 NEXT X
50 END
```

This program compiles directly into QuickBASIC as well, for those who want to potchsky (play with) such things. I invite translations of this simple program into other dialects of BASIC.

A few months ago I mentioned the new TRTY program, for PC compatibles, as one new program available for RTTY operation. With the file available on CompuServe and Delphi, I have been watching the downloads mount up, and it appears that many of you have enjoyed the program. I will continue to offer the program, at least through the summer, if you have no other source for it. Send me a 5" or 3.5" blank disk, a self-addressed *stamped* disk mailer, and $2 for handling, and I'll turn it around as soon as I can.

As always, I look forward to your input. Send it to me by mail, at the above address, or on CompuServe (ppn 75036,2501), or Delphi (username MARCWA3AJR). Watch out for the sun this summer (this is Dr. Leavey talking—not the ham), and use sunblock on the kids!

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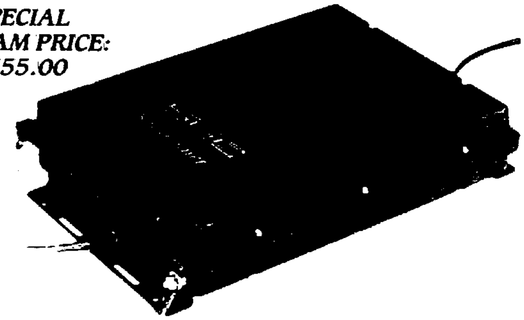

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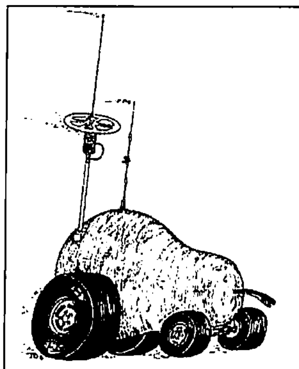

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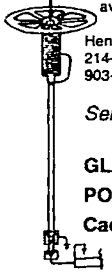

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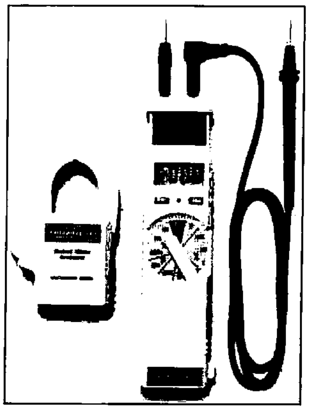
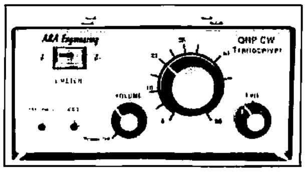


FIELDPIECE INSTRUMENTS

Fieldpiece Instruments has introduced a small (7¼ x 2" x 1") heavy-duty line of multimeters that integrates the functions of a digital multimeter, a voltage checker, and a current clamp meter in a drop-proof, contamination resistant housing. The fully sealed yellow Valox case allows the meter to withstand exposure to contaminants and drops of up to 10 feet. Superior overload protection enables the meters to withstand 1,000 VDC and transients up to 6,000V on any voltage range. Other ranges can withstand 500V. Metal oxide varistors, rather than lower cost spark gaps, are used for transient protection. The two standard "Fluke" style multimeter jacks come out the top to accept test leads, specially designed probe tips, and a specially designed current clamp head. All meters include a continuity beeper, a "Hold" button to lock the display, "Auto-off" to extend the battery life, one red probe tip, one black test lead, an operator's manual, and a rugged clear plastic carrying case. Model HS23 adds the dangerous red LED and beeper and the capacitance function; Model HS25 adds the logic probe.

Suggested list prices range from $79 to $119 for the meters, $24.95 for the Model ACH accessory current clamp head, $3.95 for a pair of standard probe tips, and $4.95 for a pair of insulated extended (2½") probe tips. For prices and more information, contact *Fieldpiece Instruments, Inc., 8322B Artesia Blvd., Buena Park CA 90621; (714) 992-1239 (telephone and FAX).* Or Circle Reader Service No. 201.



A & A ENGINEERING

A & A Engineering has released two new products, 20m and 40m QRP portable transceivers. Features include: single-signal receiver with a narrow CW crystal filter; VFO main and fine tuning, which can be set to cover any 50 kHz of a band; audio derived AGC and two stages of audio filtering for listening comfort, 5 watts output when powered from a +13.8V source; semi-QSK T-R switching with adjustable delay; CW sidetone generator with adjustable delay; and CW sidetone generator with adjustable volume. Weighing only 27 ounces, this transceiver is perfect for backpacking.

The complete kit is priced at $159.95, plus $5 shipping. Contact *A & A Engineering, 2521 W. LaPalma Unit K, Anaheim CA 92801; (714) 952-2114, FAX (714) 952-3280.* Or circle Reader Service No. 202.

CERTIFIED PRODUCTS CORPORATION

The new RED ALERT multi-use meter from Certified Products Corporation will alert users to the sources and intensity of low frequency radiation, suspected of causing cancer, from computers, power lines and other electrical sources. It will locate hidden or buried electrical lines and help prevent accidental encounters by anyone digging holes, tearing out walls, remodeling or working near electrical lines. It is priced at $69.95, plus $2.95 S & H. Contact *Certified Products Corporation, 2816 East 51st Street, Tulsa OK 74105-1704; (918) 743-0269.* Or circle Reader Service No. 203.

NCG

NCG has introduced a new COMET dual-band 2m/70cm base/repeater antenna, the CA-2x4MAX, centered to the American amateur frequencies, 146 MHz/446 MHz. This new antenna incorporates COMET's exclusive SLC (Super Linear Converter) system, which uses parallel elements in order to maintain a stable resonant frequency over the life of the antenna. It also features a new jointing system made of durable ABS plastic to screw the sections together. The CA-2x4MAX is 17'8" long and has a UHF (SO-239) connector. The reported gain figures are 8.5 dB on 2 meters and 11.5 dB on 70cm.

For the price and more information, contact *NCG Company, 1275 N. Grove St., Anaheim CA 92806; (800) 962-2611, (714) 630-4541.* Or circle Reader Service No. 204.

TOWNSEND ELECTRONICS

For those who must use an HT as a mobile rig, Townsend Electronics has introduced the "Rig Saver" universal hand-held/mobile radio mount. You can now safely mount your handheld or small mobile rig where you can see the rig's controls and digital display, and have maximum access to the controls. A vinyl-coated plate protects the rig from scratches while in use. Large knobs make it easy to adjust to any angle for nearly any HT or small mobile. This mount will fit on the console, center hump, engine enclosure or dash of virtually any vehicle.

The "Rig Saver" is available in two models: the Slimline ($24.95) and the Rough-Duty ($29.95). Add $3 S & H; Indiana residents add 5% sales tax. Contact *Townsend Electronics, Box 415, Pierceton IN 46562; (800) 338-1665.* Or circle Reader Service No. 205.

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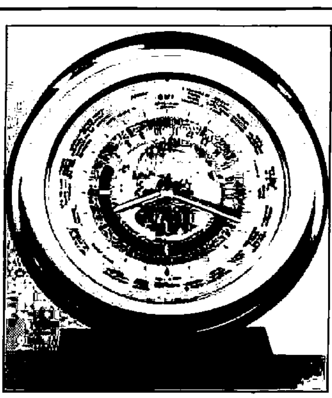

HAM Jewelry is offering an excellent station clock, the World Time Clock. This clock lets users read at a glance not only their own local time but also the time anywhere in the world, without any conversions. The names of 65 cities and countries are displayed around the clock's periphery, and the local hour at those places is read by the adjacent number on the QTR ring. Minutes are read from the minute hand; GMT is read directly from the 12 o'clock position. There is also a polar projection map of the world on the clock's face, showing the world's time zones.

The World Time Clock comes in a brushed goldtone metal case with a bright, polished faceted bezel. It will run for approximately one year on a single "C" cell alkaline battery (not included). The price is $79.95, plus $5 for insured S & H. Contact *HAM Jewelry Company, 26 Edgecomb Road, Binghamton NY 13905; (607) 797-5458.* Or circle Reader Service No. 206.

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Ampire Inc. is offering new and improved model 146, 146OS, and 440 RF switchable mast-mounted preamplifiers for 2m and 70cm, enclosed in extruded aluminum and irradiated to minimize oxidation. The plastic-coated circuit board repels moisture and corrosion. The preamplifiers have been designed to operate from +130°F to −30°F.

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ABOVE AND BEYOND

VHF and Above Operation

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Lasers and Amateur Communications

Does "laser" give you thoughts of some star war device, or just something you would like to experiment with? What can you do with a laser besides drive your neighbors crazy with mysterious spots of red light all over the neighborhood? How about using it as part of an amateur communications system? Many devices now incorporate a laser, which for the amateur means surplus availability, sooner or later. Supermarket checkout scanners are an example of this. Other sources are disc players, printers, and optical scanners. Look for them at swap meets.

What does it take to construct a grass roots laser system? I don't want to get into the fine details on lasers and light frequency relationships, only to give you enough information to get started. If you want more details, there are quite a few good books for the experimenter. One such book is *The Laser Cookbook*, by Gordon McComb. It costs about $18 from Tab Books, and it's well worth the price.

There will be three parts to this topic, the first covering basics and the power system, the second detailing the receiver system, and the third describing high sensitivity receiver modifications using photo-multiplier tubes.

Tube Testing

Surplus, a helium-neon (HeNe) laser with power supply should be less than $100. With only the plasma tube, cost should be quite a bit less. Watch out for used tubes; unless you can test them, you can't be sure they'll work. If they're bad, you can't fix them, unless you are into glass blowing and able to recharge the gas mixture under vacuum conditions.

Plasma tubes (uncased lasers), as well as heads (cased lasers with ballast resistors) have to be tested with a power supply to verify their condition. What happens to old laser tubes? Why will some of them not function? In time, the seals leak; they lose gas, and the helium-neon mixture won't ionize. However, the books I have read all state that the newer tubes have much better seals, and this is not such a problem with them.

An excellent supplier of lasers and laser equipment, both new and surplus, is MWK Industries. They also stock technical books on lasers. Their address is MWK Industries, 1296 W. Pomona, Building 110, Corona California 91720. Tel. (714) 278-0563. I can supply 10 kV 50 mA diodes, which you will need for the power supply, from my local surplus store for $7 for 6 diodes, postpaid U.S.A. I'll also keep a look out for 100 pF capacitors.

System Components

Component parts to gather for a laser communication system include a power supply (high voltage, for the laser), and a 12 VDC muffin fan for the system transmitter. The muffin fan "chops" the laser beam near a 1000 Hz rate; the spinning blades make a tone that can be detected on the system receiver. The receiver needs a large aperture lens, a photosensitive detector, and an audio amplifier to recover the 1000 Hz tone. The audio amplifier in this case is the system receiver. This month I will cover details of the high voltage power supply that you need in order to place a laser (HeNe) into operation.

Safety

Be very careful when working with a laser power supply. Don't be fooled, though it only delivers a few milliamperes at 3 kV, it can be lethal. Put the supply in an enclosure with a good ground system and use a 110 VAC 3-WIRE CORD. Protect yourself from accidental contact with the high voltage.

Also, the PC board you mount the rectifiers and other high voltage components on has to be elevated from the metal enclosure and chassis, and these from each other, to prevent high voltage leakage and accidental contact.

You can make a compact power supply by using a rubber type of potting mix to improve the breakdown insulation resistance. If you do not pot, you can coat some of the components with a Corona dope, a thick paint-on high voltage material that prevents high voltage leakage.

Inside the Tube

A starting pulse of about 10 kV must be impressed across each of two electrodes to ignite the gas in the HeNe tube into a high energy state. Usually 1500 to 3000 volts is needed to maintain this state. After the gas in the tube becomes ionized, it energizes the gas in the capillary tube, which produces a laser beam. Each end of the laser tube has two mirrors, one fully mirrored and the other partially mirrored. At the latter end, the beam exits the tube.

The laser is maintained in this high energy state by a lower power supply voltage of 1.8 to 2.5 kV. The supply must be capable of delivering several milliamperes of current at this voltage. The exact amount of current needed depends on the type and power output in milliwatts of your laser tube. This DC current could vary from about 3 to 7.5 mA for a 10 mW HeNe laser.

The first power supply I built used a 1 kV transformer (AC) with a voltage doubler providing about 2.5 kV to run the laser. I used a strobe transformer to provide the starting pulse. It worked, but was somewhat fussy. I wanted something better.

Our local surplus store had several high voltage ion generator PC boards (incomplete). Located on the board was a series circuit using high voltage capacitors and diodes, forming a voltage quadrupler. Parts were rated at 15 kV. I removed the unnecessary components and attached the quadrupler to the output of my 2.5 kV supply, and multiplied the 2.5 kV power supply output to just over 10 kV. It worked well the first time.

The quadrupler will not sustain high current operation. As soon as the gas is ionized, the tube starts to draw current and sort of disconnects the quadrupler from the circuit, then reverts to the 2.5 kV main power supply voltage. See Figure 1 for the power supply schematic.

Photo. Jack Askew VE4JX and his home-built 20-foot 432 MHz EME dish antenna in Winnipeg, Manitoba, Canada.

The trick to this scheme is that the ion generator capacitors (100 pF) are not capable of much current, but they allow voltage multiplication. As this higher current flows through the quadrupler diodes, which are now just a series network, no multiplication takes place when the laser's current is drawn. See Figure 3 for details of the voltage quadrupler.

Test your power supply unloaded, then test it with a resistive load before you connect it to a laser tube. I use an RCA Senior VoltOhmist with a high voltage (15 kV) probe. I measured the power supply output voltage (starting voltage) unloaded, and it was just over 10 kV. With a resistive load, it dropped to 2.5 kV.

Limiting the Current

The next necessary item for a universal laser power supply is the ballast resistor, the only way to limit current to the laser tube. You have to realize that some power needs to be dissipated. 2.5 kV at a few mA are a couple of watts of power. The resistors must be highvalue, around 100k, in series, and be capable of dissipating the power. In my power supply, I used a large quantity of 100k 2W resistors; I paralleled two of them and made a string of 50k resistors. I put five similar resistors in my output stack. If power supply voltage is lower, near 1.8 kV, less ballast resistors will be required.

When applying power to an unknown laser tube, use as high a value of ballast resistor as you can. It's easier to cut the value of the resistor than to obtain a new tube. Some tubes require a critical value of ballast resistor for proper operation. Laser tubes are all different, even tubes from the same manufacturer.

If a tube "sputters" when power is applied, the ballast resistor must be trimmed. The current is either too great, causing discharges, or too little, causing the current to fold back and the tube to try to re-ignite itself. Sputtering sounds like a ticking inside the tube. Take care when trimming the resistor. *Too much current hastens the death of a laser.*

My 10 mW tube runs with 2.5 kV at 7.5 mA. I have a ballast resistor of 250k, five dual resistor assemblies of two 100k resistors each. Additionally, my laser "head," a tube mounted inside a metal assembly, has an internal 180k ballast resistor. A smaller rated laser, say 2 mW, would require less current. Best operation is when you get good turn-on at lowest tube current with reliable operation. Connect a

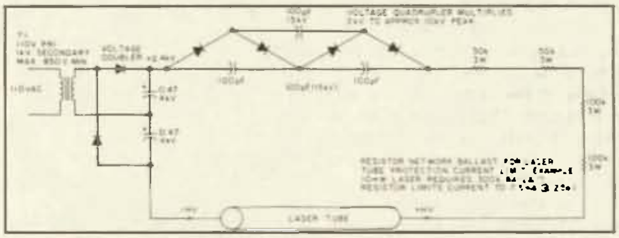

Figure 1. The laser power supply, an AC transformer 850V/1kV secondary. The voltage quadrupler provides the 10kV, low current starting pulse.

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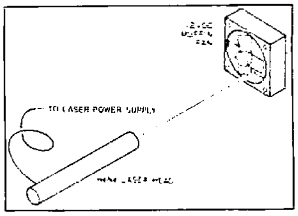

Figure 2. The laser transmitter. DC muffin fan blades chop the laser beam at approximately 1 kHz.

well-insulated current meter in series with your laser to determine the current drawn. *[Ed. Note: Do not look directly into any laser beam as it could be hazardous to your eyesight. Take appropriate precautions.]*

Mailbox Comments

Lyle K1HR of Littleton, New Hampshire, is getting ready for Field Day '91. He's building the FET switcher from the August '90 column. Lyle intends to use the switcher to provide AC power for his packet station remote. He'll also use the switcher in the laser power supply, and the 1 kV supply (to be covered in part 3 of this series). As he mentions, the switcher is versatile. Marion Brimberry of Alma, Illinois, writes that he made the FET switcher kit, and it worked great, powering from +12 volts to 110 AC, using the IRFP-140R transistor.

A couple of notes on using the switchers: I found that you can reduce a voltage spike on the FET's drain by placing a series 5 ohm resistor and A 0.1 µF capacitor on each drain to ground. If the spike is high enough (around 100 V), it can puncture and destroy the FET. The resistor-capacitor network helps prevent this. These values are for 60 Hz, and will have to be adjusted for different frequencies.

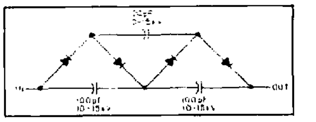

Figure 3. The voltage quadrupler details. All diodes are 8 kV at 130 mA. VARO H-1601-8 (surplus diodes). Capacitors, 100 pF; 50 pF to 200 pF should work OK.

Ross VK2ZRU of Forestville, Australia, working with Alan VK2AXA, used the San Diego Microwave booklet on 10 GHz to construct a small horn antenna and a signal source. He is about to etch a PC board for a 10 GHz transceiver, and is looking for microwave relays (SMA type). Microwave surplus is not plentiful in Australia, and I will try to assist Ross in locating some surplus postage stamp coax relays.

25th Central States VHF Conference

The 25th Central States VHF Conference will be held July 25–28 at the Sheraton Inn in Cedar Rapids, Iowa. It's open to everyone. This year Rod Blocksome K/ØDAS and his staff are planning an excellent series of activities and technical presentations. They're looking for speakers and technical papers. All questions should be directed to Rod Blocksome KØDAS, 690 East View Drive, Robbins, Iowa 52328; (319) 393-8022. Or contact Ron Neyens NØCIH, 8616 C. Ave. Ext., Marion IA 52302-9524; (319) 377-3207.

As always I will be glad to answer questions pertaining to this and other microwave related subjects. Best 73's, Chuck WB6IGP.

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

JUN 1

KNOXVILLE, TN The RAC of Knoxville will host the 25th annual Amateur Radio/Computer Convention at the Knoxville Convention Center from 9 AM-5 PM. VE Exams on site. Advance tickets $4, $5 at the door. For advance tickets mail check and SASE to *R.A.C.K., PO Box 124, Knoxville TN 37901.* For tables and info contact *Steve Fritts WA4GZE, 400 Tobler Ln., Knoxville TN 37919. (615) 525-0801.*

ATHENS, GA The Athens RC will hold its annual Hamfest at VFW Post 2872, Sunset Dr., beginning at 8:30 AM. Admission $3, 15 and under free. Flea Market and Tailgating spaces $2 each. VE Exams. Talk-in on 146.745/-. Contact *Joe Londeree KC4EJY, (404) 353-8196.*

CLEVELAND, TN The Cleveland ARC will sponsor an event at the Bradley County High School from 9 AM-4 PM. VE Exams. Admission $1. Tables $4. Free outdoor tailgating with paid admission. Talk-in on 147.180. Contact *David Evans WD4EZC, (615) 472-1421.*

HERMON, ME The Pine State ARC will sponsor the Bangor Hamfest at Hermon Elementary School from 8 AM-2 PM. Free parking. Admission $2. VE Exams. Talk-in on 146.34/.94. Call *(207) 848-3846* day or night.

TEANECK, NJ Bergen ARA will host an event at Fairleigh Dickinson Univ., from 8 AM-2 PM. Admission: Buyers $2, sellers $8, children free. Free parking. VE Exams from 9 AM-noon, walk-in only. Exams contact: *Pete Adely K2MHP, 13-30 Edward St., Fairlawn NJ 07410. (201) 796-6622.* Talk-in on W2AKR 146.790. General contact: *Jim Joyce K2ZO, 286 Ridgewood Blvd. No., Westwood NJ 07675. (201) 664-6725.*

KITCHENER, ONT. The 17th annual Central Ontario Amateur Radio Flea Market, co-sponsored by The Guelph ARC and the Kitchener-Waterloo ARC, will be held at Bingeman Park from 8 AM-2 PM. Admission $5, children 12 and under free. Vendor tables $8 per 8' space (no outside vendors). Talk-in on KSR-146.37/.97, ZMG-144.61, 145.21; simplex 52/52. Make all checks payable to Central Ontario Amateur Radio Fleamarket, and send to *Fleamarket Chairman, Ray Jennings VE3CZE, 61 Ottawa Crescent, Guelph Ontario N1E 2A8. Phone: (519) 822-8342.*

ALAMOGORDO, NM The Alamogordo ARC will conduct VE Exams at the Alamogordo Mid High School, south entrance, beginning at 12 noon.

JUN 2

MANASSAS, VA The Ole Virginia Hams ARC will sponsor the Manassas Hamfest/Computer Show at the William County Fairgrounds. Open to tailgaters at 7 AM and to the general public at 8 AM. Admission $5, tailgating $5 additional per space. Wheelchair accessible. Talk-in on 146.37/.97 and 223.06/224.66 Commercial vendors contact *Jack KI4VP, (703) 361-5255.* For info call *Jim WD4OJY, (703) 369-3940.*

CHELSEA, MI The Chelsea ARC, Inc., will sponsor the 14th annual Chelsea Swap 'N Shop at the Chelsea Fair Grounds. Wheelchair accessible. Set-up at 6 AM. Donation $3. YL's, XYL's and kids under 12 free. Tables $9 per 8'. Trunk sale, $3 per space. Ladies tables welcome. For info, send SASE to *Robert Schantz, 416 Wilkinson St., Chelsea MI 48118,* or call *(313) 475-1795.*

NEWINGTON, CT The Newington ARL will hold its annual Amateur Radio/Computer Flea Market at the Newington High School from 9 AM-2 PM. Tailgating, weather permitting. Guided tours of ARRL HQ and W1AW. VE Exams by pre-registration only. Register with *Susan Fredrickson WM1B, PO Box 165, Pleasant Valley CT 06063.* General admission $3. Tables $12. For tables and info contact *Les Andrew KA1KRP, c/o NARL, 68 Wildermere Ave., Waterbury CT 06705. (203) 523-0453.* SASE for confirmation.

PRINCETON, IL The Starved Rock Radio Club Hamfest will be held at the Bureau County Fairgrounds beginning at 6 AM. Advance tickets are $4 before May 20th and $5 at the gate. Camping and outdoor Flea Market area is free. 8' indoor tables are $10 each. Talk-in on 146.355/.955. Contact *Bruce Burton KU9A, 1153 Union St., Marseilles IL 61341-1710. (815) 795-2201.*

QUEENS, NY The Hall of Science Hamfest will be held at the New York Hall of Science parking lot. Doors open at 9 AM. Set-up after 7:30 AM. Free parking. Donation for buyers. $4, sellers $6 per space. Talk-in on 445.175 repeater and 146.52 simplex. Contact (at night), *Steve nbaum WB2KDG, (718) 898-5599 or Arnie Schiffman WB2YXB, (718) 343-0172.* (Rain date is June 9th.)

ROME, GA The NW Georgia ARC will celebrate its 60th Anniversary by hosting a big picnic at Floyd College, US 27. All hams invited! Bring one covered dish per family. Fishing and ball games. Talk-in on 146.94.

CONTOOCOOK, NH The annual Spring Flea Market, sponsored by the Contoocook Valley RC, will be held from 8 AM-3 PM. Tailgating. Directions: At Concord NH take I-89 North 14 miles to Exit 7 (Rte 103). East one half mile, on the left. From the West, take Rte 202/9 East to I-89 North, 5 miles to Exit 7, then East. Follow signs for parking. Admission: Sellers $5, buyers $1. Talk-in on 146.895 and 146.94 repeaters, and 52 simplex. Info: *K1OPQ @ pkt WA1WOK-2, or evenings (603) 746-5090.*

BUTLER, PA The Breezeshooters of Western Pennsylvania announce their 37th Annual Hamfest/Computerfest, to be held from 8 AM-4 PM at the Butler Farm Show Grounds. Mobile check-in on 28.495 and 146.520. Directions and Talk-in on 147.96/.36. Fly-in available at Roe Airport. Admission is $1 at the door. Free outdoor Flea Market space. Free parking. Wheelchair accessible. Indoor vendor space is available. Tables are $10 each in advance, on a first come first served basis. Overnight camping, hookups available. VEC Testing by pre-registration only. For info send SASE to *Rey Whanger W3BIS, Box 8, R.D. 2, Cheswick PA 15024, (412) 828-9393.* For reservations and info send check and SASE to *George Artnak N3FXW, 3350 Appel Rd., Bethel Park PA 15102. (412) 833-3395.*

JUN 7

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg. beginning at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in on 147.300. Please bring two forms of ID and a copy of your license. Contact *John Patchett KB2ERJ, (315) 487-0298.*

JUN 9

LANCASTER, NY The Lancaster ARC will sponsor the Lancaster New York Hamfest at the Elks Club Hall (across from the Lancaster P.O.). Admission $4, includes 8' outdoor Flea Market space. Talk-in on 146.550 simplex or 224.640 repeater. Contact *Chairman Luke Calianno N2GDU, 1105 Ransom Rd., Lancaster NY 14086, (716) 683-8880; Nick WA2CJJ, 5645 Genesee St., Lancaster NY 14086, (716) 681-6410; George Ebert, (716) 894-0343.*

WINFIELD/CENTRAL, PA SVARC, Inc. and Milton ARC will sponsor an event at the Winfield Fireman's Grounds, 60 miles north of Harrisburg on US Route 15. VE Exams. Free parking. Admission $4. Tailgate and table space at $1 per 6'. Talk-In on 145.18/.78 and 146.82/.22. Write to *SVARC, Inc., Box 73, Hummels Wharf PA 17831. (717) 473-7050. Packet KD3KR @ NR3U.*

WILLOW SPRINGS, IL The 34th Annual Hamfest sponsored by the Six Meter Club of Chicago, Inc., will be held at Santa Fe Park. Tickets $3 in advance, $4 at the gate. Large Swapper's Row. Free parking. No overnight parking. Gates open at 6 AM. Talk-in on K9ONA 146.52 or K9ONA repeater 37-97. Get advance tickets from *Mike Corbett K9ENZ, 606 South Fenton Ave., Romeoville IL 60441,* or from any Club member.

ERLANGER, KY The Northern Kentucky ARC will sponsor "HAM-O-RAMA 91" at the Erlanger Kentucky Lions Park beginning at 8 AM. Flea Market set-up at 6 AM. Advance tickets are $4, $5 at the gate, with children under age 13 admitted free. Flea Market spaces are $2 each (tables NOT furnished). Indoor vendor space $15 per table (provided). For info, registration, contact *LC4FET c/o NKARC, PO Box 1062, Covington KY 41012. (606) 341-1213.* Talk-in on 147.855/.255 or 147.975/.375.

GRANITE CITY, IL The Egyptian Radio Club will host the annual EGYPTIANFEST at the club grounds on Chouteau Place Rd. beginning at 6 AM and ending with the main prize drawing about 2 PM. Advance tickets are $1 each or 6/$5; $2 each or 3/$5 at the door. License testing will be at the Sanford Brown Business College, 3237 W. Chain of Rocks Rd. Exam sign-up will be 8 AM-9:45 AM at the hamfest. Saturday night camping is available at the clubgrounds. Talk-in on the ERC-W9AIU 146.76 repeater. Contact *Jim Cleland K9RKU, PO Box 562, Granite City IL 62040. (618) 344-2401.*

NEAR AKRON, OH The Goodyear ARC will sponsor the 24th Annual Hamfest/Family Picnic at Wingfoot Lake Park. Family admission is $4 in advance, $5 at the gate. The Picnic and Flea Market will be from 8 AM-4 PM. Inside tables $6 in advance. Outside Flea Market $3 per vehicle. No overnight parking, no pets, no swimming. For info and advance tickets: *William F. Dunn W8IFM, 4730 Nottingham Lane, Stow OH 44224. (216) 673-8502.*

JUN 14-16

BURBANK, ALBERTA The Central ARL will hold their 19th Annual Picnic at the Burbank Campground, located at the confluence of Blindman and Red Deer River Valleys. Semi-private camp sites available by reservation. Registration starts Fri. afternoon. Camping fees: $15 per family unit, $10 per single unit; $10 for weekend private stall; Sat. evening barbecue/dance; $5, $3 for children under 12. $6 per weekend pass (no camping). Contact *Pat Wight VE6ALD, 886-3883* or look for a message on the *CARL BBS VE6BJH.* Talk-In on VE6UK 147.150+0.600 MHz, or 146.520 MHz simplex.

JUN 15

CORTLAND, NY The Skyline ARC will present the 9th annual Cortland International Hamfest from 7 AM-3 PM at the Cortland County Fairgrounds (breakfast at 6 AM). Outdoor Flea Market space $1. Indoor space available. Advance tickets $3, $4 at the gate, under 14 admitted free. SASE by June 1st to *S.A.R.C., Box 5241, Cortland NY 13045.* Talk-in on 147.825/.225.

CHERRY HILL, NJ The South Jersey Radio Assn., Inc., will host a gala Dinner at the Cherry Hill Inn to celebrate their Diamond Anniversary. An informal gathering will begin at 6 PM with a cash bar, followed by dinner at 7 PM. Tickets are $25 each and you may bring a guest. Arrangements have been made with Cherry Hill Inn for special room rates. For hotel reservations call *(609) 662-7200* and tell them you will be attending the SJRA Dinner on the 15th. The special room rates are $62 single, $65 double; includes use of all hotel facilities and a full breakfast on Sun. morning. For SJRA Dinner tickets, enclose SASE and check/money order ($25 for each ticket) and mail to *Frances Widmann WA2NBE, South Jersey Radio Assn., PO Box 1026, Haddonfield NJ 08033,* before the May 8th deadline.

JUN 15-16

GLENDIVE, MT The Lower Yellowstone AR System will host the 32nd Annual Fathers Day Hamfest Picnic at the Dawson County Fairgrounds. VE Exams Sat. at 1 PM. There will be a hosted breakfast on Sun. Sun. Pot-Luck Dinner at 1 PM. Adult registration $6 each, kids free.

JUN 16

SANTA MARIA, CA The Satellite ARC will hold its annual Santa Maria Radio Swapfest/Barbecue at the Union Oil Company Newlove Picnic Grounds south of Santa Maria, from 9 AM-4 PM. Tables are available at 7 AM for $5. Top Sirloin Barbecue at 1 PM, $8 for adults, $4 for children. Free parking. Talk-in on 146.94. Contact *Esther Miller, PO Box 2067, Orcutt CA 93457-2067. (805) 937-8878.*

CAMBRIDGE, MA TAILGATE Electronics, Computer and Amateur Radio FLEA MARKET, 9 AM-2 PM at Albany and Main St. Sponsored by the MIT Electronics Research Society, the MIT Radio Society, the MIT UHF Repeater Assn. and the Harvard Wireless Club. Admission $1.50. Free off-street parking. Covered tailgate area. Sellers $8 per space at the gate, $5 in advance-includes one admission. Set-up at 7 AM. Mail reservation payments before June 5th to *W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.* Talk-in on 146.52 and 449.725/ 444.725-pl 2A-W1XM repeater.

STEVENS POINT, WI The Central WI Radio Amateurs, Ltd, will hold its 14th annual SWAPFEST at the University Center on the Univ. of Wisconsin-Stevens Point campus. Free parking. Wheelchair accessible. VE Exams. Tables and electricity will be available for commercial vendors. Contact *Art Wysocki N9BCA, CWRA Swapfest Chairman, 3356 April Lane, Stevens Point WI 54481. (715) 344-2984.*

FREDERICK, MD The Frederick ARC will hold its Annual Hamfest at the Frederick County Fairgrounds from 8 AM-4 PM. Admission $4, wives and children free with one paid admission. Tailgaters $5 for each 10' space. Indoor exhibitor tables $10. For info write to *Frederick Hamfest, PO Box 589, Mt. Airy MD 21771.*

JUN 22

COOKEVILLE, TN The Upper Cumberland ARS will host a free Tailgate event at the USDA Bldg., Farmers Market Section on Bunker Hill Rd., from 8 AM-3 PM. Set-up at 7 AM (CST). Talk-in on 145.11/.51. Contact *Ken Roberts, Rt. 4, Box 307, Cookeville TN 38501.*

LEMPSTER, NH The Connecticut Valley FM Assn. will sponsor a Hamfest/Fleamarket from 7 AM-2 PM at the Goshen-Lempster Coop School gym, Route 10 in Lempster. Free parking. Auction. Picnic. Admission $1. Table or space $5 each (plus 1 free admission). Talk-In 146.16/.76. Contact *Conrad Ekstrom WB1GXM, PO Box 1076, Claremont NH 03743-1076. (603) 543-1389.*

SPECIAL EVENT STATIONS

JUN 1

HACIENDA HEIGHTS, CA The Mercury ARA will participate in a community Emergency Preparedness Fair from 1800Z-2300Z. Members will operate using their own call signs. Third party traffic for Fair patrons will be encouraged. Frequencies: 28.3 to 28.5 on 10 meter phone band. For a certificate, send QSL and SASE to *MARA, Attn: WA6BZX, 2751 Montellano, Hacienda Heights CA 91745.*

JUN 1-2

TROY, OH Station W8FW will operate 1400Z-2200Z to commemorate "Strawberry Festival." Frequencies: 25 kHz up from the General 40 meter band and 10 meter Novice band. For certificate, send QSL and SASE to *KS8Z, 1408 Cornish Rd., Troy OH 45373-1212.*

MADISON, OH The Wireless Institute of Northern Ohio (WINO), sponsored by the Lake County ARA, will be on the air Sat. evening between 2330Z-0300Z on 7235 and 21315 kHz, and Sun. from 1500Z-1900Z on 21315 and 28490 kHz, to commemorate Ohio Wine Month. The station call is KO8O. A special 8½ x 11 QSL certificate will be available from *KO8O-WINO Weekend, 10418 Briar Hill, Kirtland OH 44094.* Send a legal sized SASE.

JUN 1-15

HADDONFIELD, NJ The South Jersey Radio Assn. will operate K2AA on all bands June 1-15 to celebrate 75 continuous years devoted to amateur radio. SJRA will offer an attractive QSL marking the event. To confirm contact send a QSL and a SASE to *South Jersey Radio Assn., PO Box 1026, Haddonfield NJ 08033.*

JUN 6-8

MENA, AR The Ouachita ARA will operate KG5QO from 1300Z-2400Z in conjunction with the annual "Lum and Abner Days" honoring Chet Lauck and Norris Goff of early Broadcast Radio fame. Operation will be in the lower 25 kHz of 40, 20, 15 meter General phone bands, and 28.350-400 MHz. For certificate send QSL and 9 x 12 SASE to *Jack Brewer KG5QO, Rt 1, Box 137, Hatfield AR 71945.*

JUN 9-16

AUBURN, WA The Academy ARC will operate K7AC during the week of June 9-16th, to commemorate Auburn's Centennial. Operation will be in the lower 25 kHz of the General bands as well as the 10 meter Novice phone band. There will be an informal net of U.S. Auburns (there are about 22 of them) held on June 16th at 2200 UTC, on 14.240 MHz. QSL via *WA7QCC, 3513 Orchard Place SE, Auburn WA 98002.*

JUN 17-21 & 24-28

JOPLIN, MO The Joplin ARC will operate K5ALU Mon. through Fri. from 2000Z-0200Z, from the Frank Childress Boy Scout Reservation, to encourage youth participation in ham radio. CW-7.050, 14.050; phone-lower 25 kHz of the General 40, 20 and 15 meter bands and the upper 50 kHz of the Novice 10 meter band. For QSL, send QSL, name of operator worked, and SASE to *Joplin ARC, PO Box 2983, Joplin MO 64803.*

JUN 22

LAKE KEYSTONE, OK Lake Keystone OK Masonic Dist. 12 Assn. will operate N5MBD/P from 1300Z-2200Z during the annual State-Wide Masonic Rally on the 10 meter Novice phone band. For certificate, send QSL and large SASE to *Masonic Dist. 12 Assn., PO Box 182, Owasso OK 74055.*

Ask Kaboom

The Tech Answer Man

Michael J. Geier KB1UM
WGE Center
Forest Road
Hancock NH 03449

Selectivity and Intermod: What Are They?

A recent letter to the *73* editor complaining about "poor selectivity" when using a Kenwood TH-27A HT with an outdoor antenna prompted me to think about intermod, selectivity and receiver characteristics in general. Let me share some of those thoughts with you.

The reader was picking up paging services and other transmissions which were not on the frequency to which he was tuned. He complained that his new HT suffered from this problem, but his older ICOM IC-2AT did not. Why should newer technology exhibit worse behavior?

The editor explained that such problems are in fact worse with the newer, wideband receiving rigs, and that it was not fair to single Kenwood out. He was quite correct, but the problem goes deeper than could be addressed on the letters page. In fact, the letter writer was not actually experiencing a selectivity problem per se. What he had was front-end overload and intermod. The two are quite different things.

Selectivity refers to the width and shape factor of the receiver's passband. The two are related concepts; the shape factor partly determines the overall width. So, the shape factor is perhaps the more important spec. The term simply refers to how steep the filtering curve appears when graphed on a dB-versus-frequency X-Y plot. If the "skirts" or edges of the response fall rapidly, then the shape factor is steep, meaning that signals outside the defined bandwidth will not be heard. If, however, the skirts fall off in a gentle slope, then the *effective* bandwidth is greater because signals appearing on the skirts will be passed. Obviously, the steeper the skirts, the better.

It is important to note that in today's synthesized receivers, essentially all of the selectivity is obtained in the IF stages. The front ends are usually quite broad. Let me explain.

Two Ways to Go

There are two ways to make a superheterodyne receiver. The old, tried-and-true method was to tune the front end to the desired signal and then greatly increase the selectivity in the IF stages. This system helps avoid interference because the tuned front end rejects signals on distant frequencies, but it requires that the local oscillator and front-end tuning components track each other. In other words, the front end must be resonant on the same frequency as the one which will be passed through the IFs after being mixed with the local oscillator! With a mechanical tuning arrangement, such as a variable capacitor, this is fairly easy to do.

But with a digital synthesizer, it is not as easy. The local oscillator is controlled by a phase locked loop system, driven from a digital reference. It is possible to derive a DC tuning voltage in the process (in fact, one is used to tune the VCO) and control a varactor (voltage-variable capacitor) to track the front end, but it becomes impractical over wide frequency bands. Thus, for many receivers, and especially for those which can cover large out-of-band frequency ranges, designers have turned to another technique.

Open Wide and Say Ahhhh

The obvious way to go is simply to use an untuned front end! After all, you can get all the selectivity you want in the IFs. In fact, most of today's walkies use this technique. The difference between the older units and the newer ones is that the old ones only had to cover four MHz, so there could be a broad bandpass filter ahead of the front-end amp. This very coarse tuned circuit at least kept the out-of-band garbage from getting in. Now that we all expect our pocket rigs to cover a 40 to 60 MHz spread, it just isn't practical. So, there may be no tuning at all.

So what? Why should this affect the operation of the receiver, and why does it matter what kind of antenna you use? Well, as long as the front-end amplifier stays linear, it doesn't. But, when enough signal power (generated by multiple transmitters on various frequencies) gets in, the amp is driven to clipping, just like an audio amp is when you turn the volume up too loud. At this point, the amp becomes a *mixer*. Or, if you prefer, a modulator; it's the same thing. Now, various incoming frequencies can affect each other, just as if they were two inputs to a mixer. This is called intermodulation distortion, or intermod. If the two incoming frequencies happen to add or subtract to or from the one you're tuned to, you will hear one or both of them! Also, if they mix to one of your IF frequencies, some of that resultant signal may leak through the first mixer to the IFs, causing the same effect. And, of course, there can be more than two. Sometimes, three or four signals can mix and cause trouble. Yuck, what a mess!

The reason the antenna matters is because *it delivers tremendously* more signal to the receiver than does the usual rubber duck. This greatly increases the likelihood of overload and intermod. Walkies are most prone to this problem because they are designed to be very sensitive in order to deliver reasonable performance with a poor antenna, which a rubber duck certainly is. The trade-off is that these ultra-sensitive front ends can't take too large a signal level before going into clipping. Also, many of the tuning elements, such as filter coils, which can help avoid intermod are just too darned big for pocket rigs. Many mobiles, however, have them and consequently exhibit fewer intermod problems. Such rigs usually do not have wide, out-of-band coverage.

By the way, the difference between a receiver's lowest discernible signal and its highest level before overloading is called its *dynamic range* and is expressed in dB. Obviously, the bigger the number the better. Ultimately, the dynamic range, selectivity and intermod rejection matter more than does simple sensitivity, especially in FM rigs. There usually is plenty of signal to work with—you just want to keep all the "junk" out of your passband!

Use the Right Rig for the Job

Walkies were never meant to be used with base station antennas, and most don't even perform well with mobile antennas, either. You just can't have it all in one tiny box! If you live in a small town without many radio services, you may have no trouble at all. If, however, you live in Boston, Miami or some other metropolitan area, good luck! I remember using my walkie in the car in Miami with a mobile antenna. It seemed as if my receiver had very poor sensitivity; I was getting into the repeater, but I could barely hear it. Then I tried using the rubber duck and, even inside the metal car, the repeater came in loud and clear. The receiver was being *blocked* by other signals' overloading the front end. Sometimes I could hear them, sometimes I could not.

There are few base station rigs sold anymore. If you are setting up a base, a mobile radio with a power supply makes a better choice than does a walkie.

TX Too?

What about transmitters? Can they suffer from intermod, too? Yes, they sure can! As a matter of fact, repeater operators have that problem quite a bit, because the repeater is often located on top of a hill or tower only a few feet away from other high-powered transmitting devices. But with no "front end," how does a transmitter get intermod?

The mixing occurs right in the transmit final amp! In FM transmitters, the final amp is not linear in the first place. Typically it is a pulse amp, with the pulses being converted to nice clean sine waves by the tank circuit (a resonant coil-cap circuit) and the low-pass filters at the output. The inherent nonlinearity (read "distortion") in these amps makes them ripe for intermod problems, because they are already being driven to clipping by design! So, if enough extraneous signal energy gets to the amps, it will cause mixing and the transmitter will then broadcast the intermod far and wide.

There's an easy way to tell if a repeater's intermod is on its receiver or transmitter: If it is still there after the receiver's squelch has dropped (but before the transmitter shuts down), then it is not coming from the receiver!

It is highly unlikely that you will ever generate your own intermod, even if you use your walkie as a base station, because it takes a substantial amount of unwanted signal energy to get past the transmitter's output filter and into the final amp. Unless you have another big transmitter with its antenna very close to your walkie's, you should be clean.

Are They All the Same?

I've used a fair number of walkies in my day, and I do feel that the "big three" manufacturers have different receiver design concepts. In my opinion (and this is only my opinion—go to a ham club meeting and you'll find people who will disagree), here's how they stack up in general.

ICOMs seem to have the best balance between sensitivity and selectivity, each being a little bit less than the best available separately from the other two, but both being extremely good.

Yaesus have the best selectivity. If you're off 5 kHz, the signal is barely listenable, and if you're 10 kHz away, it is practically gone. However, the rigs are not as sensitive as those from the other two. There have been some exceptions, though, such as the old "Memorizer" mobile rig, which was about the most sensitive 2 meter radio I've ever seen.

Kenwoods have extremely high sensitivity, and it holds up well outside the ham bands. The rigs are not terribly selective, though; it can be hard to tell whether or not you're 5 kHz off.

As far as intermod rejection is concerned, I can't offer any opinion because I haven't used the radios enough under adverse conditions to make a judgment. All I can say is this: No matter who makes them, walkies do not excel in this area. After all, everything has limitations.

Now, let's look at a letter:

Dear Kaboom,

What's the difference between a Class A and a Class B computer? I know it is in regard to the amount of RFI that the computer is allowed to generate, but what does it actually mean? Also, what measures can I take to ensure hash-free computer operation in my shack?

Signed,
Classy

Dear Classy,

Contrary to what one might think, a Class B computer is "cleaner" than a Class A unit. The A designation is for computers to be used in a business environment only. The RFI specs are somewhat looser than those for Class B, which is for home use. It is assumed that homes and apartments will have various susceptible devices, like TV sets, in close proximity to the computer. As long as the machine is in a metal box, most of the RFI will exit via the cables used to connect the keyboard, video monitor, printer, etc. There is no way to be sure you won't get any hash in your shack, but you can do a few things to lessen the severity of the situation. First, use shielded cable for everything you can, including on the computer and the rig. Second, ground the rig well. Third, try to keep the computer as far away as possible. Fourth, wrap computer cables through toroids if you can. Finally, consider going to a laptop if all else fails. These CMOS-based machines put out *far* less hash than the tabletop variety because they operate on much less power to begin with. By the way, some older computers, like my Apple II+, were not even shielded at all. Man, they are serious noise generators. Hmmm, I wonder if I could put a CW key in the micro's reset line and have a wideband QRP rig? Only kidding! 73

Number 24 on your Feedback card

LOOKING WEST

Bill Pasternak WA6ITF
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Saugus CA 91350

W3BE: Radio Amateur of the Year

In case you have not already heard, I am honored—proud—elated—to report that the Dayton Amateur Radio Association has named one of the nation's best known and most respected "amateurs in public service" as the 1991 Radio Amateur of the Year. The person I speak of is someone whom I have been proud to call a friend for the past decade and a half. That ham and friend is John B. Johnston W3BE of Derwood, Maryland, and also of 1919 M Street N.E., Washington DC.

Many of you know W3BE as Johnny Johnston of the FCC, the Commission representative you meet at hamfests and conventions across the nation. His reserved yet knowledgeable approach to discussing matters of regulation has made John a friend to many of us, and a man who is respected by all.

Johnston was nominated by a coalition of amateurs from across the country. They felt that his two decades of dedication to the regulatory needs of the nation's amateurs deserved major recognition. In their letter of nomination, they cited John's almost single-handed re-write and reorganizaton of the Part 97 amateur rules as one of his major contributions. They noted that this was not a task assigned to him by his superiors in the Commission, but rather done at his own initiative. He used his unparalleled knowledge of the amateur service rules to address the problems that their ambiguities were causing to the amateur service. It was also noted that in his position as Chief of the FCC's Personal Radio Branch, he has always made himself available to help members of the amateur community to find solutions to their problems, while also working to ensure an appreciation of amateur radio within the structure of the FCC.

We have heard more than one person say that honoring W3BE for his years of service to the United States Amateur Radio Service is long overdue. John has become almost inseparable from the service regulations that his hand and mind helped create. Apparently, the D.A.R.A. Awards Committee heard the same call to honor him and his work. It is my opinion that John B. Johnston W3BE is the best friend we amateurs have in the ranks of the FCC.

220 Gone

John Johnston W3BE being named Radio Amateur of the Year was the good news this spring. Now here is the bad. John's superiors at the FCC—the Commissioners—say that hams will have to be off of the 220 to 222 MHz band by midsummer. While no exact date can be given, amateurs will have to vacate the band entirely 90 days after the effective date of the rules change, adopted on Thursday, March 14, that takes hams off the lower part of the 1-1/4 meter band and puts commercial services on. The NPRM was adopted pretty much as proposed, with the addition of a reserve of some channels for public safety use. Automatic vehicle monitoring will probably be available through the entire band.

The FCC rejected the ARRL's request for secondary access to 220–222 MHz. The American Red Cross lost in its request for special frequencies, as did Electronic Tracking Systems, Inc., for police tracking units. And regarding PELTS, the Personal Emergency Locator Transmitter System, no decision was made. *[For more information on PELTS, see the Nov. '90 "Homing In" column.]* Some hams say they won't leave the band. They believe that the FCC won't enforce the new rules. If these hams insist on staying, they may have to put their licenses, wallets, and possibly their personal freedom on the line. Isn't it time to let the matter stand? It was a good fight, but we lost!

13cm Offered to Business

Mind you, I am writing this column on April 1. I wish i could say, "April Fools!" but alas, I can't. And, as if the loss of 220-222 MHz was not a bad enough way to enter the spring season, now the 13cm amateur band appears to be up for grabs. In fact, it may be given away by the FCC at next year's World Administrative Radio Conference (WARC '92). The Commission is proposing that it be turned over to commercial use for digital audio broadcasting and satellite uplinks for worldwide mobile services.

Specifically, the FCC suggests that 2360–2410 MHz—including the 2360–2390 MHz slice of spectrum now off-limits to amateurs—be given to the satellite-based Digital Audio Service, and 2410-2450 MHz become an uplink band for mobile satellite services. This would leave hams with only 2300–2310 MHz, and this only on a secondary, totally noninterfering basis to any and all other users who might receive assignment at a later date. The FCC also proposes that hams be granted some limited, noninterfereing access to the entire band. The key word appears to be "noninterfereing," which could mean anything to anybody, since no designator for what constitutes "interference" has ever been determined for blanket application across the entire electromagnetic spectrum.

The proposal to reallocate 13cm is a part of the overall United State's position paper for next year's World Administrative Radio Conference. It should be noted that most countries in the world, especially the emerging third world countries, are already set against the Amateur Radio Service retaining its 20 and 40 meter bands. The FCC's offering the 13cm band up for grabs only strengthens the position of those seeking to gut amateur operations in all spectrum from DC to light.

Michigan—"Privating Out" OK

Let's close with these two items about FM and repeaters. Ever hear the term "privating out"? In the world of FM and repeaters, it means that a repeater owner has decided that he no longer wants the general amateur community to have access to his machine. So, he puts the word out that, as of a specified date, the repeater will only be available to selected users of his choice. In effect, he has evicted the overall amateur community. He has taken an "open" repeater and has "privated out."

Michigan has a long tradition of opposing any closed or private repeater operation. Now it will not only permit the establishment of closed and private repeaters, it will also permit existing systems to go private if they so choose. The Michigan Area Repeater Council made this new stand public in its February newsletter.

The question of whether or not to permit private repeater operation in this state came to a head several months ago. As noted, Michigan traditionally banned closed and private systems. Then, last fall several repeater trustees informed the council that they were changing to closed operation. Another refused to give the council some key system access information for its records. They decided it was time to discuss the privating-out issue.

In the discussion, which took place last December 1990, the Michigan Area Repeater Council determined that the issue of private versus open operation is strictly the province of the repeater owner, and not the business of the coordinating body.

However, the council also demanded that no matter which type of operation a repeater owner chooses, he must supply all data needed for the coordination body's technical database. The lack of this information, the Michigan Area Repeater Council says, will seriously detract from that organization's ability to coordinate spectrum usage.

The Big MACC

We can at least end with a story that reads like an April fool's joke, even though every word is true. Can you believe that a hungry "Big MACC" has eaten two more states? In this case, the Big MACC we are talking about is the giant Mid America Coordination Council.

Late word is that the Big MACC has become even larger, bringing Ohio and Indiana under its umbrella. This makes 13 the total number of states represented by the MACC. It also makes the Big MACC the largest coordination council in the United States, and the largest political representative of FM and repeater interests in the world. In matters of repeater coordination policy, it is probably more politically powerful than the ARRL!

Number 25 on your Feedback card

UPDATES

ROBO-COPy

See the above article in the Oct. '90 issue, page 28. *Important: See also the update in the Dec. '90 issue.* Mike Hansen WB9DYI, the author, has sent us the latest revision of ROBO-COPy, version 3. They are currently listed on the 73 BBS (in the 73Mag SIG) at (603) 525–4438. The file named robo31.exe is for COM1, and the file named robo32.exe is for COM2.

WB9DYI: "ROBO-COPy version 3 uses the RI input of the COM port, and is thus completely compatible with the interface circuitry of the robo2.exe. (The correct pin number for RI on the DB-25 connector is 22.)

"Version 3 is different from version 2 in two areas:

"1. A fix was installed in the routine that prevents the average from being skewed by a large number of repetitive dits or dahs.

"2. A correction factor was added into the the word-per-minute calculation to compensate for the different sampling filter settings. This yields more accurate wpm readings at the HI filter setting. Note that the wpm calculation is based strictly on the speed of the incoming dits and dahs, and does not actually count the number of "words" sent over a 60-second period, like an FCC code exam. On-the-air tests using W1AW show the new algorithm to be accurate to plus or minus 3 wpm.

"*Note:* Early models of the Tandy 1000 series of PCs do not have truly compatible COM port BIOS routines. They lock up when attempting to run ROBO-COPy.

"Well over 100 hams have contacted me about ROBO-COPy. I appreciate any feedback or recommendations. Please contact me via the 73 BBS under 'mch" or by mail at 1405 Tangle Wood Dr., Algonquin IL 60102."

Subscribe to *73*
Call:
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Number 26 on your Feedback card

QRP

Low Power Operation

Mike Bryce WB8VGE
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Field Day Success

With the June flowers, comes Field Day: both a contest and an emergency communication exercise many hams enjoy. Plans for a winning Field Day are developed all year long. The average QRPer can make a good showing when operating Field Day, and have a lot of fun to boot!

There are two things you must have to complete a successful Field Day operation: power and antennas. Last year I operated the full 24 hours of Field Day with a 6 amp/hour gel cell battery. A small Arco GP100 solar panel kept the battery charged. There was no need to have a charge controller connected to the battery, as a constant load was maintained by the Argonaut. The primary mode was CW, with a dash of SSB thrown in. While I didn't generate an earth-shaking score, I worked just about everyone I could hear.

The Expanded Voltmeter

I brought along with me a simple and very handy piece of test equipment: an expanded voltmeter. A dedicated state-of-charge meter for lead-acid and NiCd batteries can be built very easily with four basic components: a zener diode, a resistor, a potentiometer, and a 0–1 mA meter. This hand-held voltmeter will allow you to keep track of battery voltage without guessing. Of course, you could use one of the many inexpensive digital meters on the market, but this device is simple and costs very little to build. If you step on it and break it, you're not out a lot of money.

Here's how it works. The voltage across the zener diode is essentially constant with respect to the current passing through the zener. If the battery voltage moves around, which it will (that's why we are doing this in the first place), the zener voltage will remain fixed at 10 VDC. The design concept is to use a meter to measure the difference between the fixed zener voltage and the battery's positive terminal.

Because the really important voltages are between 10 and 15 VDC, that's what we'll measure. Since a fully charged lead-acid battery is nearly 15 VDC (in most cases, the voltage of a fully charged gel cell battery is 14.4 volts under charge) the meter will then need to cover a range of 0–5 volts, since we are referencing against the zener diode voltage.

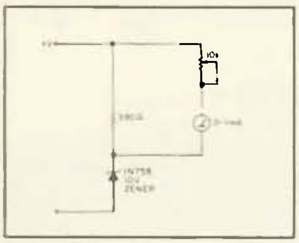

Figure. Make an expanded voltmeter for Field Day

Easy to Build

Construction is, by design, simple. Only four components are needed. You'll need a 0–1 mA meter, a zener diode, a resistor, and a trimmer pot. Check the parts list on the schematic. A suitable meter is available from Radio Shack. The meter, as it comes from the package, is a basic 0–1 mA meter.

Remember, you *don't* have to use the meter from Radio Shack. Any 0–1 mA meter will work. I've used 0–50 microammeters and they've worked fine. I've even used old surplus 270 deg meters without trouble. Use what you have! If you want to use the Radio Shack meter, its catalog number is RS 270-1754.

In fact, you can get all the parts needed for this project from Radio Shack, with the exception of the 10 volt zener diode. I have a stock of these here in my junk box. If you can't find the zener diode called for, drop me a letter. I'll send one off to you for the price of two first class postage stamps. One for the diode, the other for the return postage.

Conversion of the meter is a simple matter of adding the extra components to a small piece of perf-board and changing the face of the meter. Since the meter's face already says "DC Volts," all we have to do is change the scale. You'll need a pair of steady hands, some small screwdrivers, and a dab of White Out™. A sheet of press-on letters will be needed to re-mark the meter's face. Of course, you could always re-mark the meter's face with a pencil or pen, too.

Place a soft cloth on your work area to prevent the meter's clear plastic face from being scratched. To remove the plastic face, hold the bottom of the meter in one hand, and pop the face off with the other hand. You'll find two parts to the meter's plastic face, the face itself and the black shield. Lay these aside.

Notice the two Phillips screws holding the scale to the body. With a small jeweler's screwdriver, carefully remove one screw. Be sure you don't drop the screw into the meter's hair spring or moving coil. Remove the other screw. Now, don't lift the metal scale off; rather, *slide* it off. Replace the two plastic parts and set the meter aside. This will protect the fragile needle and hair spring.

Lay the meter face down on a hard surface. You don't want to bend the metal plate. Since one end of the meter's scale is already marked 15 volts, you only have to change the zero at the other end to a 10. Use the White Out and cover the unneeded scale numbers. After the White Out has dried, use a press-on number to re-mark the scale, from 10 volts where the zero used to be, to 15 volts on the high end. The middle of the scale is 12.5 volts.

Photo A. The completed, expanded voltmeter keeps an eye on the battery.

As a thought, some colored highlighters could be used to mark the scale in yellow, red, and green. If you don't want to go to all this trouble, use a pencil and remark the scale by hand. The first method is much more professional looking, though. Reassemble the meter and put it aside for mounting in an appropriate cabinet. A Radio Shack plastic project box works quite well. I used a Radio Shack #270-233.

The actual circuit may be assembled on perf-board or a simple PC board. Hard wiring may also be used. I assembled the circuit and used a piece of double-sided tape to hold the board to the inside of the plastic box holding the meter. Several feet of test lead wire and clip leads finish up the construction. A rubber grommet protects the wires from chaffing on the plastic box.

Calibration

To calibrate the meter, you'll need a variable power supply and a digital voltmeter. Using the digital voltmeter, set the power supply to read 15 volts, and adjust the 10k trimmer for a reading of 15 volts on the expanded meter. Change the voltage to 12.5 volts and note the reading. It should be in the middle of the scale. That's all there is to it.

Because of the tolerance of the analog meter and the zener diode, the expanded voltmeter may not track 100 percent with the digital voltmeter. Since we're interested in the range from 12 to 14 volts, adjust the trimmer for the most accurate reading between these two points. The expanded voltmeter will be accurate to within 0.1 volt. Button everything up and start using your expanded voltmeter.

Just one word of caution when using the meter: Don't measure the voltage at the load unless that is where you want to see the real voltage to the device. If you connect the voltmeter to the load, you'll see the voltage drop from the battery to the load.

The best place to put the voltmeter is right at the battery, not the load. You can use this to your advantage, however. If you measure 12.5 volts at the battery, and then only 11 at the load, you've got some serious trouble in your power connections. An easy fix is increasing the wire size between the load and the battery.

By using this expanded voltmeter on your battery-powered equipment, you'll always know their condition. This may keep your signals from chirping away on CW or FMing on SSB. You don't want to be known for a nasty signal in this year's Field Day.

The expanded voltmeter will be a welcome addition to your Field Day's war chest, right beside your death ray antenna. 73

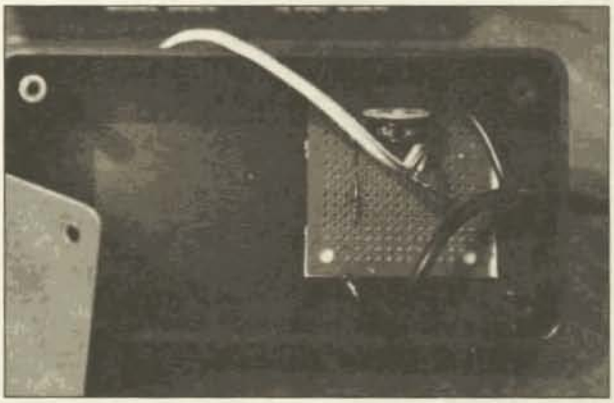

Photo B. Inside the expanded voltmeter: Only three components needed!

Never Say Die

Continued from page 4

want to spring for the 12-second 4.5 kHz passband chips. Just what you need to make that 2" speaker sound good when you talk with someone.

If your message is longer than 20 seconds the chips work just fine in series. Talk as long as you like.

These are being made by Information Storage Devices of San Jose and samples are already being shipped. (See the "New Products" section of *73*, May 1991.)

Just think of how much time you'll save by being able to read *73* while in a QSO and only having to speak the other chap's call and name one time! Or play Nintendo, watch a ball game on TV, or whatever you do to fritter away your life.

What about the other chap's transmissions? Don't you have to waste time listening to them? Nah, just program in a cheery, "Okay on everything OM," and forget it. He's probably using a QSO machine too, right?

Think of how much aggravation you can save during contests by using one chip to call, "CQ contest" and another to give your contest number, automatically incremented. Chip 1: "XZ2AB." Chip 2: "This is W2NSD portable 1 in New Hampshire. QSL. Your number is five nine." Chip 3: "One six seven" (this one increments to give the three numbers in sequence). Back to chip 2: "Is that a roger?"

A sharp contest operator should be able to keep at least two rigs going simultaneously, one on each end of the band, thus doubling his score. I'd arrange for a cassette recording of all contacts so I wouldn't even have to log the received contest numbers until later.

Let's get cracking on some QSO machine designs. The winners will get their circuits published in *73* and probably find ten new companies (and five old ones) offering royalties to manufacture their invention. Put me down for 10% of your royalty or I'll sue.

Now, for those of you whose sense of humor rotted off years ago or was destroyed during puberty, while the chips are real and the applications will work, I'm not serious about suggesting totally automatic contacts.

For those of you who think I surely must be kidding, just wait until you see some QSO machine articles. And for those of you who are confused and aren't sure whether I'm serious or not, well, golly, me either. Now get started chipping away so I can fill my log and write editorials at the same time.

You can call Jim Oliphant N6OBM at (800) 825-4473 for more info on the ISD chips. Tell him Wayne sent you.

Crowded Two

I have a message for you to pass along, if you will. If you dare! I happen to think you are too chicken to speak up. Well, I'm not.

The next time you hear some old addle-brained idiot grousing that the no-coders shouldn't be allowed on two meters because the band is already crowded enough, please break in and tell him that Wayne has a message for him: He's a foolish fossil and should apply immediately for his Silent Key certificate for the brain-dead.

Two meters crowded? In what universe is that? Sure, maybe in Tokyo, where they have about five times as many hams as we do. Don't tell me about crowding; I get around too much and I listen. In the last year I have called in on every repeater I could reach while visiting Los Angeles, Denver, Las Vegas, Chicago, New York, Dallas, Nashville, Minneapolis, Boston, Kansas City, Dayton, Columbus, Mobile, New Orleans, San Diego, Portland (ME), Troy (NY), and a few more cities. Oh, I've made a few QSOs, but 99% of the time all I get is a kerchunk and silence. Not only are the repeaters not in use, no one is even listening to them.

Oh sure, every repeater channel is occupied. I can often raise a dozen or more repeaters. There just isn't anyone listening to them. So tell me all about how crowded two meters is and I'll tell you you're full of . . . er . . . baloney. From what I've experienced in every part of the country we could handle ten times as much activity on 2m without causing any problems.

I realize there's no way to get through the ceramic minds involved. They've never let facts or reason even remotely influence their strongly held, frequently expressed beliefs. These tend to be the same fuddy-duddies we hear sounding off about Jews, blacks, Japs, homos, wetbacks and so on.

There's nothing new about hatred and intolerance. Alas, I don't see any signs of the human race improving in this respect. No learning curve here. We see groups all around the world anxious to kill other groups for religious, racial or tribal reasons.

Unless you're married to them, you generally have to not know someone in order to hate them enough to want to kill them. Communications can make a big difference . . . even in marriage, where it's rarer even than on 2m.

Amateur radio is about the only medium where people can talk with people in other countries. Even tourists rarely get to talk to more than hotel employees or waiters. We have an enormous tool for helping the world to change, but we've been trashing it with idiocies such as the DXCC award.

We also have 125,000 Techs self-imprisoned up on 2m, where they can't talk much further than they can see. The world will get no help from them. It's a pity that in a time when people-to-people communications are so desperately needed, that so many of us are handcuffed to the VHF bands, imprisoned mainly by a terror of the code.

I've tried to push Techs to get their General licenses before. A few have reacted intelligently, but many have gotten angry. That damned Wayne Green! It's this sort of reaction which has probably prevented any other ham rags from even trying to write about such a delicate subject.

So okay, get mad at me, if that makes you feel any better. But the worst part of that is that you know I'm right. Your only out is to get even madder. Your alternative is to admit that, yes, I'm right and you have been taking the easy way out. Yes, it takes some work to get a higher license. Is work really that awful?

Techs and Novices, we need you down there on 15m and 20m. We need you there badly. The chaps who are there have made such a mess of those bands that they're like inner city slums. You're going to be absolutely disgusted when you hear how bad it is. You'll hear Extra Class hams chasing DX hams off the air any time they surface. You'll hear these roving gangs of terrorists assaulting rare DX with merciless pile-ups until they are battered and bruised and give up.

They don't have the slightest interest in talking with the chap in some rare country. All they want is a QSL card and they don't care what it takes to get it. I'm old enough to remember when "green QSLs" were dollar bills. Now they're $20 bills.

A few DX hams have gotten addicted to our green QSLs and it keeps 'em going, despite the treatment they get. If the value of the dollar keeps dropping, they're going to start demanding pictures of Grant's tomb instead of the Bush homestead.

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

We desperately need you Techs down there to introduce a whole new concept to amateur radio: actually talking with people in other countries. Making friends . . . not just for yourself, but for America too.

There's a destructive phenomenon that takes place when two groups (or even people, like husbands and wives) are not in good communication with each other. I've never seen anyone else write about this, but I've seen it in action and it's a corker.

When communication is limited between two groups, what communication there is tends to get blown all out of proportion. Paranoia sets in.

Techs, we need you to get off 2m, at least part of the time, and start talking with hams in France, Germany, Hungary, Estonia and so on. We need to let them know that we're interested in them . . . in what they do, what interests they have, what problems, what successes. Have they any questions about what America is really like? What's their perspective on the EC? What do they think about Bush, Gorby and Saddam? What ethnic problems do they have to cope with?

Look around for some African stations and start finding out how it is to live in Kenya these days. Uganda. Have you ever actually talked with a South African about what's going on down there? You'll find a completely different perspective from anything you've read in the papers or heard on PBS, I guarantee.

We need you to get down on our DX bands and start cleaning 'em up. Don't succumb to the DXing craze. Let's get together and force *QST* to isolate the DXers' band pollution they foment just to DX contests.

Now, am I bad-writing the League? If you call a constructive plan to help our hobby and our country bad, I suppose so. Let's see some Techs with guts getting their local clubs to start General study classes and moving cleanup squads into 20m. It wouldn't hurt to start at the top of 20m and clean up the awful messes on 14.313 and 14.275. Then get up some steam and charge down the band, leveling those rotten pile-ups as you go. Take no prisoners.

. . . de **W2NSD/1**

Golly, I almost missed our sked. I was busy sending some comments to the Candy Company on a recent petition intended to help solve the packet brouhaha. You know, where some idiot put a message into a packet system asking people to call a 900-number about some sort of stopping the war political baloney.

Sure enough, some ham got a wild hair and complained to the FCC, an action which should be punishable by death or worse, and the next thing you know official harassment was the order of the day. The foolish ham who started the chain reaction with his dumb message brought all the innocent relayers

whose stations automatically passed along the packet into the soup.

What should have happened is that when someone noticed the dumb message they should have let the originator know what they thought ol him screwing up like that. When we ask the FCC to solve problems for us they almost invariably do it with an atom bomb, leaving us in shock and having to fight the fallout for years afterward.

Anyway, in case you're interested in my comments, here's what I wrote. If not, pour yourself a cuppa coffee and skip it.

Tom Blackwell N5GAR and Joe Jarrett K5FOG petitioned the FCC to put the responsibility for an "illegal" message on the originator.

Secretary FCC
Washington DC 20554

Re: RM-7649—Amending the repeater rules

Yo, Commissioners:

The amateur radio service can benefit our country only if it is permitted to develop new technologies with a minimum of interference. Indeed, amateur radio can be an enormously valuable resource.

It's well known that most scientific breakthroughs have been made by amateurs. Professionals normally can't afford to spend the time and money it takes to pursue technologies that have only a slight chance at success. Amateurs can. Most fail, but the few who succeed are worth all the failures and more.

Radio amateurs developed most of our present communications modes. Jack Babkes W2GDG developed and pioneered narrowband FM back in 1946. That's the primary communications mode for mobile VHF and UHF today. I was one of his helpers in this project.

The first practical single sideband communications system was developed and pioneered by an amateur (Don Noregaard)...as was slow-scan TV (Copthorne McDonald). W8JK invented the helical antenna. W1FZJ invented the practical parametric amplifier (on 6m) and I published the first articles on this discovery in 73.

Today's cellular telephone system would be unlikely if the technology hadn't been developed by amateurs in Chicago. I published the circuits for this system almost 20 years ago. Amateurs were the driving force that got microcomputers going. Today amateurs are developing packet communications systems. They need all the latitude possible to develop and pioneer this new system.

When the FCC formed the Long Range Planning Committee (LRPC), the group quickly decided that the only *dependable emergency communications system we have in America is amateur radio. Since the high speed automatic relaying feature ol packet radio is a key element in building emergency networks, the current FCC decision to block this is harmful to both the development of packet technology and to the long range interests of America. I was a member of the LRPC from its founding.*

The rule change proposed in RM-7649 provides a simple solution to the problem that the FCC has caused. I recommend it be accepted until even less restrictive rules can be devised.

Amateur radio needs less rules and more latitude, not federal harassment. Technology is the key to the future, so the FCC should be working with the amateur radio industry to devise ways to increase the number of youngsters attracted to the hobby, not closing off experimental areas from development.

Sincerely, Wayne Green W2NSD/1

Naturally the Commissioners didn't allow enough time (a crummy 30 days from March 6th) for us to get the word out and get enough comments on this sore subject to have some weight.

Some Progress

The big problem we have in amateur radio today isn't the new no-code Techs, it's the old-timers who have their heels dug in and are fighting progress. The new Techs are getting high marks from every corner.

While I want to thank the many readers who've been crediting me with getting the no-code license accepted, I don't feel that a 33-year fight finally won is much to crow about. If we'd gone this route 30 years ago when I started pushing for it, I believe we could well have five million hams today instead of under a half million and that the U.S. might still have a consumer electronics industry.

I've recently been talking with some of the microcomputer pioneers. If you've got some old issues of *Microcomputing* or *80 Micro*, you can look back and see where, if Radio Shack had followed my urging, the whole world today might well be TRS-DOS instead of MS-DOS, and Radio Shack would probably be around $50 billion ahead of where they are now.

If Texas Instruments had paid attention, instead of dropping $635 million on their TI-44/A computer, they could have parlayed it into a $10 billion a year new business.

So many might-have-beens! With Sony now looking to acquire Apple, if only Jobs hadn't beaten Wozniak with his Lisa vs. Apple II battle we'd be way ahead of the present 80486 technology...and Jobs would be on top instead ol a loser with his NeXT...and the Woz back teaching for a living.

Sigh, back to the present, our next goal is to not just welcome our new Techs, but to get hundreds of thousands of 'em in and on the ladder to General. If you hear any old-timers grousing, throw a pail of ice water on 'em and get 'em to cool that crapola. Tell 'em to get an enema and get aboard the world of the '90s.

We need to bring in a few million young hams. We need to get cracking on narrowband technologies. We need to go digital. There's plenty to do to clean up the mess we've made. We need less baloney on the bands. We need to get rid of pile-ups and other such intentional interference. We need several thousand new ham clubs. We need to encourage every active ham to spend at least an hour a week learning more about technology. Clubs can help here. Tech sessions over repeaters will help. Our new *Radio Fun* should help a lot.

We're beginning to make some progress. The VEC system I began pushing over 20 years ago got accepted and is working well. Ditto the repeater regs I urged almost 20 years ago. These were all fought tooth and nail by the ARRL, as were the RTTY regs I started pushing in 1951 with my first publication, *Amateur Radio Frontiers*. The League finally lost, as they always do, but only after having wasted years of our time.

Never mind my grousing about the League and their eternal politics. Their eye is on the money and that means the millions they make from ads in *QST*. My goals have always been to get things done...but not to lose enough money in the process to put me out of business.

I'm having fun today with my new recording studio. I'm working on some poetry CDs, some children's books on CD, promoting prerecorded DAT tapes, independent label distribution, and at least a half dozen new publications.

When I was young I loved to read the *Oz* books and the Ernest Thompson Seton wildlife books. I don't know if kids today will enjoy them as much as I did, but I'm going to read 'em and put 'em on CDs and see what can be done. And there's a bunch of fantastic poems by an old friend of mine that should be read and put out on CDs too.

I'm disappointed that in my 40 years of publishing ham magazines I haven't come across anyone who's been able to capture the excitement of our hobby in poetry. I guess we're too left brained to be artistic, eh? Yet we have Jean Shepherd K2ORS and his marvelous stories, so we're not all nuts, bolts and ICs.

Is there anything in our rules which says that our QSOs have to be boring and repetitious? I know our regs pretty well and I don't recall anything that prohibits us from being entertaining during a contact.

How many contacts have you had where someone read you a story or a poem? Has anyone even read you an interesting article? Even out of a ham magazine? Maybe we can break our 70-year-old pattern and start a new generation of hams who use our magical medium to actually communicate. Sigh, I suppose that's too much of a change to ask. Perhaps, in 30 years, if we've still got any frequencies, and long after I'm gone, perhaps we'll have a generation of amateurs who finally understand the concept of communications.

Exchanging trivia...even less than one would get at a cocktail party... isn't communicating. Sure, it's difficult to get into a deep conversation with someone you've never talked with before. But you're doing it with hams you've been talking with for years.

I'm finally beginning to get letters telling me about the most exciting times some of you have had in amateur radio. Great stuff! I'd love to hear from more of you. I really don't care what rig or antenna you're using as long as I can hear you. I want to talk with *you*! I want to know what you particularly enjoy about amateur radio. I want to know what other things you enjoy, if there are any. Heck, even if you enjoy sitting down to watch *The Simpsons* with a brew, at least you'll be telling me about yourself. Yes, I enjoy *The Simpsons*. It comes in on channel 25 here, so I finally gave up and got an antenna splitter so I could record the high channels. Recording programs makes it so I don't have to go to the fridge during commercials...part of my weight maintenance plan.

I love *Roseanne*, *Murphy Brown* and *Hunter*. *Law & Order* is usually good. *60 Minutes* is usually worth checking out, but my fast-forward button gets used a lot when they stretch things too much. So why is Wayne writing all this garbage? To give you some idea of things you can talk about. TV shows, movies, music or books, magazine articles...all are fodder.

I hadn't realized how much our welfare program was responsible for the mess in our inner cities...the single parent families...the teenage pregnancies...the crime and drugs. Once I read about it, it all made sense. If you'd contacted me after I read that you'd have gotten an earful.

If you're from around San Diego I'd ask if you know about the organ concerts every Sunday at 2–3 p.m. in Balboa Park. I've got a nice DAT of a concert sent by a reader. And I'd undoubtedly be able to work in a brag about being at the helm of a nuclear sub last year. Hey, when we have some coups we don't keep 'em too carefully hidden.

Now get down there on 2m and start talking with our new no-code Techs and get 'em on the right track. See if you can get 'em to try 6m too. And some Oscar contacts. And packet. Tell 'em how much fun you've been having with these.

Tell 'em how much fun you had going on a DXpedition to a Caribbean Island. Explain how little it cost and how big the pile-ups were. Tell 'em how it felt to be king of the hill for a change.Or did you pop up to St. Pierre? That's close and inexpensive to visit...and you couldn't find a more friendly people to visit.

Maybe you haven't DXpeditioned yet, but at least encourage the new Techs not to pass up this incredible part of our hobby. Explain that the code is simple when they use Uncle Wayne's system, so not to let that keep them away from the fun of talking with DX or even being DX.

If the concept of working DX being fun is alien to you, then it's time to wipe DXCC out of your mind and start actually talking with DX ops. A chap from

Spain sent me some flamenco CDs, so I sent him some ragtime CDs in exchange. Golly, I haven't visited Spain since 1976 . . . I've got to make some time to get over there again. And it's been even longer for Sweden and Aland! Meanwhile I'll be talking with the friends I've visited when I hear them on the air.

If you run into Father Moran please say hello and tell him I'm hoping to get some time to visit again. Ditto any of my friends In Sabah.

Oh, I almost forgot, yes, I know what you mean about the new no-code Techs. And no, I don't think we're heading toward a CB-like problem. Heck, if you've listened to 20m in the last year you know the mess Herb KV4FZ and his gang have made there is as bad as anything we've ever heard on CB.

I'm not sure credit is due to Herb and his destruction crew, but they sure have totally destroyed any pride we amateurs have had about amateur radio as compared to CB. I used to do a lot of CB operating and never in my life have I heard anything like the mess Herb and Baxter, K1MAN, have generated.

Self Education

While lecturing to a graduate student (MBA) class I mentioned several things which I expected any reasonably intelligent group should understand. Faced with a room full of blank stares, I asked for a show of hands on how many of them were reading any news magazines. You know, like *Newsweek* and *Time*. A few raised their hands—most didn't.

Hmmm, no wonder so few youngsters today have heard about amateur radio. Few of them have heard about *anything*. If they don't teach it in school, then it must not be important, I guess.

This almost tends to bring up a question we should be asking: How can we get word of amateur radio to the kids? This isn't exactly a new question. We've been asking it ever since amateur radio growth dropped into the pits 25 years ago. We've been asking it, but no one has been answering.

Some ham industry people got together a few years ago and worried the question. Someone suggested, "How about getting kids interested in hamming via comic books?" This eventually ended up with the ARRL sending out *Archie* ham comics. Tens of thousands of these later we still haven't seen any significant response. Do you suppose it may take more than one mention of amateur radio to get kids' attention? I notice that MacDonalds doesn't rest their whole business on one mention. Nor Pepsi.

Before I get into some possible ways of getting our message across to youngsters, let's just mull over this situation where our kids aren't reading any more than is required for school. That's bad news for them and for our society as a whole.

Firstly, since they haven't been reading, they may not even be aware of how seriously they're being shortchanged on their education. They may not realize that they are getting one of the poorest educations in the civilized world. Or that this has resulted in America losing its competitive edge in one industry after another.

Not knowing that they are being shuffled through our schools with a minimum education, they have no way to know that how educated they are in life depends almost entirely on their own initiative and that they're unlikely to get much guidance from their "teachers."

I was fortunate in a couple of respects. First, our school system wasn't nearly as bad 50 years ago as it is now . . . though it was bad enough even then. I hated it. Second, I had the marvelous experience of attending the Navy Radio Materiel School. How the government managed to actually do something right is inexplicable. No doubt a first. That school was fantastic. I believe it contributed significantly to our winning WWII.

The down side was that it was so good it soured me even further on our socialized compulsory education system.

The Reading Habit

Though I read quite a bit when I was young, it was mostly fiction . . . Tarzan, Tom Swift, Oz, Benchley, Potter, H. Allen Smith, and the wonderful Ernest Thompson Seton books, for instance . . . it wasn't until I got deeply interested in clinical psychology that I began to go heavily into nonfiction.

Kids today have a big world to keep track of. That means reading. I'd recommend *Newsweek* for general news (forget the daily newspapers), *Insight* for more in-depth news, and *The New Yorker* for real depth. I also highly recommend *The Public Interest* and *Foreign Affairs* for a better understanding of current events.

Reading these will also give you an enormous number of things to talk about on the air. And you'll be able to talk intelligently, not just express uneducated opinion based on a shallow understanding. People who've taken the trouble to know what's going on get fed up listening to that baloney.

I recommend that kids also keep an oar in the water on technology, too. They should have an understanding of current events in genetics, cosmology, particle physics, chaos theory, fuzzy logic, and so on. Magazines such as *Popular Science*, *Discover*, *Omni*, and even the *Scientific American*, will help keep you abreast of science developments.

If the Arabs we watched screaming and yelling in support of Saddam Hussein had had much education, I believe the whole Middle-Eastern situation would have developed quite differently.

How many kids today have an understanding of the major world religions? Of how they started? What the people believe?

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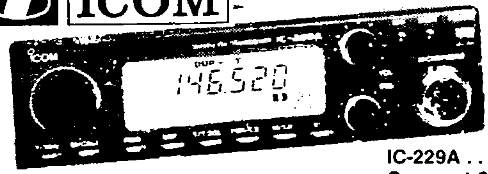

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height in his neighborhood and the local authorities have ignored the FCC on the matter. He wrote to the ARRL and got stiffed. He wanted to know what I'd suggest he do. The local hams are at their wits' end.

I wrote, saying, "Yes, the ARRL certainly should do something about your lousy situation. That's what a real national ham organization should be set up to help with. The fact is that the League has been very reluctant to tackle legal cases to help hams. When I mention this I get angry letters claiming I'm attacking the League. No one ever tries to tell me it isn't true; it's just that I shouldn't mention it.

"Now, what to do. First, I recommend you start a petition around and get signatures. Get hundreds. What should the petition say? How about pointing out that in times of emergency, such as hurricanes, which are not unknown in Florida, the *only* practical source for emergency communications is amateur radio. You can quote from my editorials about the FCC's Long Range Planning Committee, which determined this was an absolute fact.

"To provide the needed emergency communications infrastructure, a service must already be in daily use–and this means antennas and towers. The beauty of amateur radio as compared to any other communications service is (a) amateurs are everywhere; (b) they fund their own equipment; and (c) they can provide long, medium or short range communications, as needed. I'd include some pictures of ham club communications buses and vans.

"Then get the signatures at every hamfest and other event. Don't let one single ham get away from Dayton without getting a signature. Get the manufacturers and dealers to cooperate with petitions at their booths.

"Politicians react very positively to long lists of signatures. That's what I brought to the FCC in 1973 when I initiated the biggest set of rule changes in the FCC's history.

"Find out who your enemy is. Which specific politicians are doing this? Then do whatever it takes to get them unelected. Make their lives miserable. Organize public confrontations, complete with the media invited. Picket.

"Who is the chair of the Florida League of Cities? Go after this person where he or she lives. Get local hams to picket this person as not caring about lives and families. Cite discrimination against technology. When a hurricane comes and lives are lost, and medicine and food are not available, then will the people who are supporting this monster put on some pressure?

"How about getting a video camera and staging some Mike Wallace-type live interviews with the offending politicians? You'll drive 'em crazy and get wonderful material for club meeting showings.

"I hope that is enough to get you started."

When you're faced with a problem like that, be creative. There's *always* a way to solve problems. . .even when you're dealing with the government. Well, almost always. . .there's always the IRS. . .

Kids

Have you been doing your homework like I asked you. . .or have you been doping off again? Well, while you were sitting there with a cold 807 in one hand watching a ball game, I was out there in the trenches for you. . .facing the enemy.

Wait'll you stand there, facing a whole room full of 10-year-olds, trying to explain amateur radio to them. You're not going to try and tell me that your local school isn't going to let you come in and talk to (with) the kids, are you? Give me a break! They'll be delighted and you know it. It's just that you haven't *bothered*.

Well, I put off some meetings at what I smilingly call "work" and had at a bunch of the local kids. I worked 'em over and got 'em all fired up. Now they're anxious to set up a station so they can get on the air and talk. What are you going to do about it?

You know as well as I do that you've got an old rig in the closet somewhere that you aren't going to use again. Even if it doesn't work very well (or at all), the kids will go bananas if they can get it and fix it. This is a lot better use for it than lugging it to a flea market and getting a few bucks. The money will soon be wasted on food and you'll have nothing to show for it except a little extra poundage on the scales. Well, I'll get you a letter from the kids telling you how much you've helped them.

Coincidentally, the same day as I talked with the kids in Antrim (NH), I got a call from the nearby Crotched Mountain Foundation. This is a rehabilitation center and special school for handicapped children. They're going great guns in getting their kids interested in hamming and they desperately need some gear for their station.

Kenwood, ICOM and Yaesu get a hundred or so requests for free rigs a week, so that's not where you turn. The real ham gear mother lode lies in your house. There are tens of thousands of old rigs out there with their electrolytics drying up and their transformers rusting.

A good friend of mine got the idea of collecting old, no longer needed oscilloscopes from labs and getting them to schools. This has almost turned into a business for him.

Well, I've got a little room left in my barn to store a few rigs so we can get them to schools that need them. I haven't got much room because we just cleaned up the barn and made enough room to build a state-of-the-art recording studio and that's filled a lot of the back of the barn.

The best bet will be for you to drop me a note telling me what you've got available in old ham gear. I'm starting with two local schools that need rigs, but I'll bet I'll get a hundred letters from other schools when they read this. I'll try and match your gear with a school. That way you'll know where it's gone.

If you'll start giving talks about how much fun amateur radio is to your local school kids, you'll get a real kick. They love the idea of talking to the world. They're excited about packet and talking with *Mir* and via our other satellites. They can hardly wait to start building things.

One of the projects I've got scheduled for my new recording studio is to start reading some books onto tape so we can put out books for kids on CDs and cassettes. I was amazed to find that almost 100% of the kids I was talking with are avid readers. Yep, they're actually reading books!

They'd all heard about the "Wizard of Oz," but most of 'em didn't know there are 13 Oz books. I'm planning on recording 'em all. When I was their age I read 'em all and loved 'em.

None of the kids (or teachers) had heard of Ernest Thompson Seton, so they've got a fantastic surprise coming when they hear me reading his books. I read 'em all when I was a kid. Over and over. They're wild animal stories told from the perspective of the animals.

I was surprised, too, that so many of their parents take time to read to their kids. Perhaps New Hampshire parents are different, but half of the kids in the class said their parents regularly read to them. That's what got me interested in reading. When I was young my mother used to read to me every noon when I was home from school for lunch.

For older people (and kids, too) I'm going to start reading the Kai Lung books by Ernest Bramah. Too bad if you don't know how wonderful they are. Maybe I'll get you to try a CD or cassette.

I'll be reading some poetry, too. . . probably starting with Eugene Field and his "Poems of Childhood." I've been surprised to find that many people aren't familiar with Field. Tsk.

It's fun to share enthusiasms with people. That's mainly why I'm into publishing. I'm sharing my love of music, poetry, books and amateur radio. You can share your excitement over amateur radio with the kids in your local schools. Help 'em get a club going. I'll see if I can round up some equipment from *73* readers to help. Let's dig out some of those old rigs, dust 'em off and see if they're working.

Send me a note telling me what you've got available. . .send it to: Rigs for Kids, *73 Amateur Radio Today*, Forest Road, Hancock NH 03449. 73

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Tom (W6ORG)
Maryann (WB6YSS)

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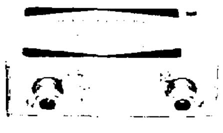

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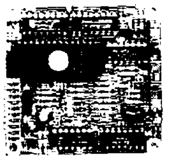

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HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. You may also upload a listing as E-mail to Sysop to the 73 BBS, (603) 525–4438, 8 data bits, 0 parity, 1 stop bit. Thank you for your cooperation.

Wanted: Instruction manual for operating EICO Model 232 VTVM. *Meyer Minchen AG5G, 4635 SW Fwy., Houston TX 77027. (713) 622–6161.*

A Kenwood TS-140S was stolen from the Towson State University ARC on Nov. 25, 1990. Its serial number is 9100556 and it has a TSU property tag #144378. It had no optional filters and was about a year old. The TS-140S was our only piece of high-quality modern gear and it will be extremely difficult to replace. Anyone with information should contact *John Egger K3GHH, Towson State Dept. of Economics, (301) 830–2954.*

Calling all Vietnam-era MARS Operators! MARS officials have asked Dr. Paul Scipione AA2AV (MARS callsign AAA9PR) to write a book about the history of MARS operations during the Vietnam War (1964–1975). Scipione has developed a database of more than 200 Nam MARS ops, but estimates there are several thousand more. If you are one, or know one, please contact Scipione for a MARS Nam questionnaire. His book (to be published in 1992) will have a section with the names and current callsigns and QTHs of MARS Nam ops, to help reunite old friends. Write *Scipione AA2AV, 5 Burr Drive, Metuchen NJ 08840*, or call *(908) 548–8096*.

Please help. I need some crystals for Heath HW-16 to get a new Novice on the air. I will pay the postage. Send info to *Jim Clark WD5HMM, Rt. 1, Box 468, Cleburne TX 76031*. Thanks.

I am a veteran of the Afghanistan conflict, and would like to organize a meeting with American ham Vietnam veterans to discuss world peace. Last summer nearly 80 Soviet vets got together and worked with the special call, R3AFG (Russia 3 Afghanistan). Their goal is to invite American vets to the Soviet Union during the summer of 1991. If interested please write to *Alex Marchenko UA0CT, P.O. Box 1, Garovka-2, Khabarovsk 682305, USSR.*

Wanted: A copy of the manual for Collins 516E-1 or 2 mobile power supply. I will pay costs. *J. Orgnero, Box 32, Site 7, SS 1, Calgary AB T2M 4N3, Canada.*

I am a Novice and would like to obtain info about equipment for fox-hunt sniffing. I need to know what companies sell it, what is commonly used, and how small the transmitters can be made. *Bob Walker, Box 65, Galiano Island BC, Canada.*

I need a copy of the schematics or booklets on the SBE-33 transceiver, the Hallicrafters SX-101 receiver, and the Hallicrafters HT-34 transmitter. If anyone knows of any upgrades or improvements to these, please let me know. I will pay reasonable copying costs. *Paul Christie ex K2UKT, 208-27 15th Road, Bayside NY 11360.*

Needed: Manuals for Regency MT-15 and MT-25 marine 12-channel, commercial BTH 201/301/204 etc., 1, 2 and 4 channel, and some UHF. Please send me a post/QSL card stating what you have, copy fee, or whether you are willing to lend for me to copy. Many thanks. *David J. Brown W9CGI, 14670 N. Cumberland Rd., Noblesville IN 46060*, or FAX via *Jim Adams WA9BHF, (317) 253–8384.*

I am looking for two books. One is the MCS-65 Users Manual for the 8085 microprocessor. The other is published by Zilog for its Z-80 series microprocessors, explaining pin functions and machine language instructions. Thanks, in advance, to all who can help! *Scott A. Littfin N0EDV, P.O. Box 1215, Hayward WI 54843.*

I need documentation and/or software/hardware supporting the RS Model III and a Sanyo "Silver Fox" MBC 550-2. Any help appreciated. *M.M. Barrette N1GPV, 21 Breton Ave., Sanford ME 04073-3236.*

I am 14, and working on my Novice ticket. I would like to ask all the hams out there if they have any extra stuff just collecting dust which could get me started towards my Extra license. I would also like to ask if any ham in the Modesto, California, area has any interest in helping me get my Novice license. I'm having a lot of trouble with the code. *Brandon Wilson, 920 Briggs Ave., Modesto CA 95351.*

Wanted: Literature for Cushcraft antenna models A-147-11, 124-WB and Ten-3. Also, schematic for Heath HWS-2 hand-held transceiver. *Glenn Torres KB5AYO, Rt. 1 Box 580-B, Reserve LA 70084.*

Law student gathering info for thesis. If you feel the FCC has ever violated your constitutional rights, please send a brief summary to *George F. Arsics, Jr., 2571 Bethany Ln., Powder Springs GA 30073.*

Needed: Diagram for a Bear-Cat BC-250 scanner and any info on modifications. Also need manual and diagram for Tempo One or FT-200 Yaesu transceiver. Any one have programs for RS Model 4 computer for ham radio? Need also diagram for CW/filter/enhancer that appeared in *QST* a few years ago. Will pay copying and shipping. Send quote to *Patrick Benesch KN4MA, Gen. Del., Loyall KY 40854.*

Please send me names and addresses of people or companies who supply communications software for the Atari 520/1040 STE computers. Also, systems to send and receive CW, RTTY (Baudot & ASCII), modified ASCII, etc. *Leonard Saddler, 1420 Reeve Ave., Bakersfield CA 93307.*

I need copies of any and all available documentation (manuals, software, schematics, etc.) for the Seequa "Chameleon" portable computer. This machine, circa 1984-85, had both 8088 & Z-80 CPUs, and could run MS-DOS & CP/M software. Will supply disks and pay costs. *T. Mark Long, 901 Chalk Level Rd. Apt. V-11, Durham NC 27704. (919) 471–3147. Evenings & weekends.*

DESPERATE!! I need an inexpensive tranceiver and/or antenna for any band 6 meters thru 440 MHz. Have my license but not a lot of cash to buy equipment. I hope someone out there can help me, I'm dying to get on the air. I'm not fussy. Please write me if you have a spare rig you would like to sell to someone who would greatly appreciate it. *Dave WB1FDZ, P.O. Box 892, Northboro MA 01532.*

I am in desperate need of an owner's manual for an IC-730. Will pay all expenses for good copy. Call collect between 8 a.m. and 1 p.m. CST. *(501) 898–6716.*

I am helping John Allen Phillips, 424 W. Cedar, Durant OK 74701 to become a ham. He has been blind since 1977. He has no equipment except a code practice oscillator I built for him. Any used ham gear would surely be appreciated. Thanks. *Randy E. Cassels KA5JTX, P.O. Box 11, Atoka OK 74525. Mr. Phillips' phone number is (405) 924–2386.*

I am looking for any information on any Wilson tribander 3-element beam antenna. I will pay any cost involved. *Don Lloyd KN5OQ, 810 Wolf Trail, Casselberry FL 32707.*

Old-timer, since 1929, desperately needs used HF transceiver, preferably small, like IC-735, FT-757, Argosy II, etc., in good working condition. Many thanks in advance and best 73. *Zbigniew M. Rybka SP8HR, ul.Radzynska 18 m.66, 20-851, Lublin 57, POLAND.*

Wanted: Manual/schematics for Scott Instrument Laboratories telemetry FM receivers, models 1312-1 through ? More than happy to pay for originals or copies. *W6HNI, P.O. Box 1017, Carpinteria CA 93014.*

I have a Kenwood TR-2500. I am looking for the TU-1 tone unit. Please contact me. *Ken Chaffee KK6VU, 36983 Oak Glen Rd., Yucaipa CA 92399.*

I am looking for the Ludvigson Tonegen, reviewed in the Feb. '88 issue of *73*. The address has changed and is not in the directory. Does anyone have a copy they could share? I will gladly pay postage and expense. *Gary Sherard WA5FLV, 700 D St. SE, Miami OK 74354, phone (918) 542–7142.*

Wanted: Digital readout. Modification kit for Ten-Tec Century 21 (Model 570). Thanks. *N0LHJ, 493 Ironwood Dr., Ballwin MO 63011.*

Dx

Hams Around the World

Bob Winn W5KNE
℅QRZ DX
P.O. Box 832205
Richardson TX 75083

QRP DX?

I did something this year that I never intended to do. I've been telling people for years that I wouldn't do it, no way! But I did it anyway—I operated QRP!

I operated QRP during the early hours of the ARRL International DX CW Contest. I don't know what caused me to do this, excessive sunspots or middle-age crazies (my XYL suggests it is over-the-hill crazies). Whatever it was, I just sat down in front of my 100 watt transceiver/kW amplifier station and "unloaded" my transceiver to 5 watts and proceeded to work stations.

It was easy (uh, relatively easy), and within the first hour of the contest I had worked enough stations to qualify for the Worked All Continents Award. After that, with WAC under my belt, I was really hooked. The adrenalin was pumping, and I was having fun.

I started working on DXCC/QRP. It seemed to be as easy as working stations on a kW, but then I realized that it wasn't. It took a few more calls to work each station. I had to use good DX operating techniques; I was stalking new countries, aiming correctly, and hitting the target. One hundred QRP countries were within sight.

This brings us to this month's column, and the topic of champions—DXing techniques. We'll begin a series of discussions that may be of benefit to all DXers.

DXing Techniques

Though it helps, you don't have to have high power and big antennas to successfully work DX. In most cases, technique is more important than power. Most stations outside of the U.S. run 100 watts or less, but they are still successful.

What are good DXing techniques?

Almost anything you do that yields another notch in your country count is a good technique, as long as your behavior in the pile-ups is reasonable and ethical. You should not cause undue interference, call out of turn, call the DX station long distance to arrange a QSO, etc.

If you spend 15 hours in the same pile-up to work a station, your technique—if it can be called that—is faulty. *The secret to successfully working a DX station is to put your signal on the frequency where the DX station is listening.* It is that simple. But, of course, it helps if your signal is the only one on that frequency, and the DX operator is cooperating!

The DX Operator vs Technique

The best technique in the world, even coupled with high power and big antennas, is often of little use if the DX operator is a poor operator. Here are a few examples. A DX operator who sends CW at 50 wpm often creates confusion, because many calling operators cannot understand his instructions (such as JA only, Europe only, UP 10, etc.). A DX operator who asks for USA only, then proceeds to work Europe is asking for trouble, confuses the callers and makes your job more difficult. A DX operator who states "UP 10," but who in fact is working stations 5 kHz below or 40 kHz above his frequency is difficult to work.

Practical Techniques

Okay, let's discuss techniques. There are only a handful, but with numerous variations. Each one may be modified to suit your needs or the situation.

First: *Listen, listen, listen!* You must listen to the DX operator and understand how he is working other stations. It is usually foolish to jump into a pile-up without first understanding what the DX operator is doing, where he is listening, and whether he is working split or on his own frequency.

After listening to the DX station for a few minutes, confirm his identity. Then note whether he is taking full callsigns only, parts of callsigns, or repeatedly "QRZeding" when he cannot pick out a callsign. How fast is he working stations? Is he working stations on or near his own frequency? Is he announcing where he is listening? Is there a distinct break between each station he works?

Second: *Listen to the policemen.* The policemen on the frequency can often provide clues about the DX operator's operating pattern. If they continually say "UP 10, DWN 5," or such, the DX operator is working in split frequency mode, or "split" operation. That is, he's listening on one frequency and answering on another. His listening frequency may be either above or below his transmit frequency. In split operation, the separation from his frequency will usually be from 2 to 10 kHz on CW. On SSB, separations of 5, 50, 100 kHz or more are not unusual.

Third: *Listen to the stations he is working.* Listening is the name of the game. If you cannot hear these stations, try rotating your antenna to see if you can find them.

If he is working stations on or near his own frequency, determine how close to his frequency they are. And, is there a pattern? Always a 100 Hz higher? 200 Hz? Does he work stations farther away from his own frequency each time, but never more than a half kHz or so?

If the stations he is working are on his own frequency, your task is simpler in one respect, but more difficult in another. You'll be sharing the frequency with all of the other callers.

QSL Routes

3D2XV	via VK2BCH, direct only
3X1AU	via ON6BV
3X1US	Arnold Olivo, US Embassy, Box 603, Conakry, Guinea
4F3BAA	via NR8Y
4K1ADO	via UA1ADQ
4K1F	via UA1AFM
5W1JC	via W9GW
7Q7MS	via FD1LRQ
8P9FF	via WB2UYM
8P9X	via K4FJ
9J2HN	via JK1UWY
9L9DXG	Box 10, Freetown, Sierra Leone
A35DJ	via DL3MDJ
BV2AL	via OZ1LGF
BV2DJ	P.O. Box 91, Yungho Taipei, Taiwan
BZ4RBC	P.O. Box 538, Nanjing, People's Republic of China
CO4QH	P.O. Box 1529, Isle of Pines, Cuba
D68KN	via JL3UIX
D68YD	via JL3UIX
D68YH	via JL3UIX
EI7M	via EI5FT
F6EWE	Gerard Aurieres, 10 Ch Le Tintoret Apt. 294, F-31100 Toulouse, France
FG5R	via W7EJ
FW0BX	via ZL1AMO
IT8A	via IK8HVH
JY9WF	via HB9ARP
N3JT/HK0	via W2GHK
ON9CRJ	via JP1TRJ
P29AC	via VK8AC
P43DO	via W4WSZ
PJ4/K2NG	via WA2NHA
PJ7/K2KTT	via K2KTT
RA2FM	Box 888, Kaliningrad 236016, USSR
RO6/RB5FF	via UO5WU
RJ0J	via UJ8JMM
T22XX	via DL2GBT
T22YL	via DL5UF
T32PG	via NH6UY
TA2ZA	Operator Robert: Robert W. Kipling And Sokak 2/16, 06680 Cankaya, Ankara, Turkey
TO6REF	via F1DBT
TW3M	via FE1JCG
UA0KAP/A	via KL7HBC
UT8U/RB5AA	Box 8, Sumy 244014, USSR
V29A	via W4FRU
V29M	via KQ2M
VP5VDV	via WD4JNS

If you have determined that he is not working stations on his own frequency, your task is to find the pile-up of stations who are calling and working him. He is working "split," and he may be listening almost anywhere, but hopefully not too far from his transmit frequency.

The DX operator may specify where he is listening, or the policemen may offer a clue (as explained above). If not, then you must hunt for the group of stations calling him. This task is more difficult if more than one popular DX station is active in the same area on the band.

Finding the pile-up on SSB is easier if the DX operator is operating on what we call "the usual DX frequencies": 14145, 14195, 21295, etc. In this case, "the usual calling frequencies" are: 14150–160, 14200–210, 21300–310, or some reasonable variation. Don't forget to check below his frequency, too.

Until next month: listen, listen, listen, and try to understand what each DX operator is doing before you call and call. Next month, we'll discuss how to put your signal right where the DX operator is listening.

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Number 31 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey, NH 03431

Notes from FN42

One of the great things about working for 73 is that I have access to many international electronics and ham radio magazines. Some of these magazines are published in English, and others are not. And I only speak, read, and write in one language, English.

I have a few of these magazines sitting on my desk right now. They represent the Soviet Union, Czechoslovakia, Switzerland, Italy, Germany, and Australia, each in its native language. What can I do except look at the pretty pictures?

Well, I can read the schematics to a great extent. Circuit layout, and the symbols for values and most components, are universal. In some countries, the convention is to use a comma instead of a period to represent a decimal, but that's not too hard to figure out. The only difficulty I might have is with some of the labels; inputs and outputs, for example, are in the native language.

In the text, the callsigns are in letters and Arabic numerals. I can see similarities among the languages, though I'm no linguist. Certainly, what's most important is that all these magazines were developed with the love of electronics and amateur radio as the focus. Regardless of the language, they convey that love, and also the desire to further our knowledge of the world around us.

I am sorry I don't understand all these languages, as I know I would learn a lot more about this hobby that I love. I had to put my desire to learn basic Russian on the back burner, as we say, because I had too many irons in the fire. Hopefully, I will be able to resume my attempt in the fall. Even a little learning makes the world a better place; though people speak different languages, we all have much in common.

A couple of items regarding the April column: The name of one of the members of the 4X90BS crew (Photo E, April 1991) was left out. He is Motti 4X4PE, 4th from the left on the top row between 4X6YY and 4X6EA. Next, look at Photo C. A new prefix for you prefix hunters? No; the photo was unintentionally reversed during production and printing. Sorry, Tino. At least we got the callsign right in the photo caption.—Arnie, N1BAC.

Roundup

Japan From the JARL News: The annual JARL-sponsored Ham Fair, one of the biggest events of its kind, will be held at the New Hall of the Tokyo International Trade Center at Harumi, Tokyo, as last year. Ham Fair '91 will run from Friday, August 23 through Sunday, August 25, 1991. Last year this fair attracted a total of 59,000 visitors.

On the first floor will be various events, including a much-waited special commemorative radio station, 8J1HAM. Not to be forgotten will be the JAIA Fair (sponsored by Japan Amateur Industries Association) displaying their tempting array of various updated and sophisticated equipment.

On the second floor, many amateur radio clubs will be giving a full account of their activities and selling heaps of "junk" at their own booths, midst a friendly and exciting atmosphere.

Next in *The JARL News*, the All Asian DX Contest Schedule has been changed so as not to coincide with the annual Ham Fair. Effective this year, the schedule is as follows: PHONE: The first Saturday of September, from 00:00 UTC through 24:00 of the following day (instead of the third Saturday of June); CW: The third Saturday of June, from 00:00 UTC through 24:00 of the following day, instead of the fourth Saturday of August.

Included in the JARL newsletter were "Rules of ARDF Competition Amended" and "Extension of the 'WARC '79' Award." Both provided lengthy information and will be placed in the 73INTL Special Interest Group portion of the 73 BBS (connect info provided on the "Table of Contents" page of the magazine).

U.S.A. Although most hams were aware that the April STS-37 shuttle mission had an all-ham crew, much of the public didn't know. Thanks to *The Wall Street Journal*, many more will now know. Featured on the front page of its March 28, 1991 issue was "Hams in Space," informing the reader that all five astronauts on the coming *Atlantis* shuttle flight are licensed amateur radio operators. Also, it stated that the first all-ham crew was inspired by its pilot, Ken Cameron, who's active in radio education.

U.S.S.R. Andy Fyodorov RW3AH writes: "Big Circle" is a unique undertaking that includes several dog sled expeditions to northern regions of Asia, America, and Europe.

In 1990, the "Big Circle" expedition passed across the Chukot Peninsula, and ended on Wrangel Island in the Arctic Ocean.

In 1991, there will be an expedition to the North Pole.

In the 1992–1995 period there will be expeditions in the "Super-Arctic Circle" series through the snow and ice of the Chukot and Alaska peninsulas, and the arctic regions of Canada, Greenland, and Scandinavia. Americans, Russians, and representatives of other northern nations will take part in these expeditions.

[Andy sent his QSL card which depicts the friendship that has developed between the U.S.S.R. and the U.S.A. Just think what might happen if more common ventures are started between countries throughout the world. Amateur radio has been doing these things for many years.—Arnie]

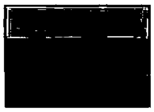
ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
Packet: 4X1MK@4Z4SV.ISR.EU

Israel gets 6 meters! I'm happy to report that since the beginning of February, a sliver of the 50 MHz band has been made available to Israeli radio amateurs. It should be noted that this band is not an amateur allocation here in ITU Region I, yet due to the interest shown by amateurs in Europe and Asia in the band, certain countries have been opening up some of the spectrum. Happily, Israel has now joined them, and 4X/4Z will be a sought-after prefix on 50 MHz.

Operating conditions are somewhat restricted: Only Class A licensees may operate on 6 meters and from 50.100 to 50.150 MHz with a maximum output power of 25 watts. Nonetheless, when the band is open, as it is now quite often here at the peak of Sunspot Cycle 22, you don't need too much power to get out!

By the time you are reading this, hopefully Morel 4X1AD will already have his SSB/CW station operating on the band. Six meter enthusiasts are advised to listen as well for weak FM signals, as it is possible that some stations will be activating military surplus gear.

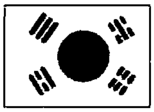


LITHUANIA

Jonas Paskauskas LY2ZZ
PO Box 71
Siauliai 235400
Lithuania

Lithuanian Amateur Radio Conference. By now, many of you have already made your plans for the Lithuanian Amateur Radio Conference scheduled for the first week in June in Vilnius, Lithuania. Even though we are still experiencing some political problems, conference plans are still continuing.

We are not the only ones that are continuing with our plans. Other organizations are holding conferences and group meetings, including an international folk dance festival. Come and have a good time with us.



REPUBLIC OF KOREA (SOUTH)

Byong-Joo Cho HL5AP
PO Box 4, Haeundae
Pusan
Republic of Korea 612-600

Commemorating the 30th Anniversary of Amateur Radio Operation. Thank you very much, everyone of the world, for your contacts on the air under the special callsign of HL30AP from September 1 to December 31, 1991. It has been 30 years since I began operating under the callsign of HM1AP *[the second first class amateur radio operator license issued after HM1AD]* when Korean nationals began operating in 1960.

I started up with a home-brew rig, using an 807 tube in the final and running 15 watts. I contacted many DX stations all over the world. I would like to express my sincere appreciation for all of your warm friendship and goodwill extended to me. I'll cherish the excitement and joy I've shared with so many amateur stations, and hope our mutual ham-life continues prosperous.

I have made a special QSL card for HL30AP, and I would like to send it to all who have made contact with me under that call. Please send your QSL with an SASE.

During March 9–12, 1991, I visited Taipei, Taiwan, for the inaugural meeting of the Chinese Taipei Amatuer Radio League (CTART). At the general

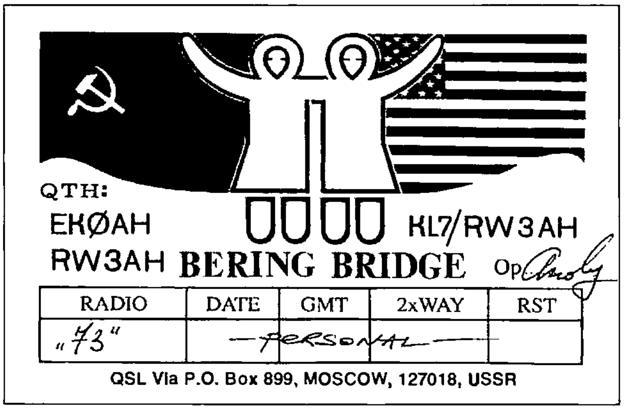


Photo A. The QSL card of Andy RW3AH commemorating the Bering Bridge, the bridge between the U.S.S.R. and the U.S.A.

Photo B. The special QSL card of Byong-Joo Cho HL3ØAP/HL5AP commemorating 30 years of amateur radio operation. Clockwise, beginning at the callsign, the photos show: 1961, 1970, 1975, and 1990

meeting there were many guests, including Mr. Rankin 9V1RH/VK3QV, chairman of IARU Region 3; Mr. Hara JA1AN, president of the JARL; Mr. Song HL1CG, on behalf of the KARL president; and Mr. Uchibori JA1IRT, editor of *CQ Ham Radio* (Japan). I attended as a guest of the KARL as an elder statesman (charter member). Some Okinawan hams and about 300 members of the CTARL attended. During this celebration, they operated their league station BVØARL.

If you need a contact from anyone in BV-land, I can introduce you to one of my friends who is very active on SSB and CW from Taipei. He is also a keen award hunter. 73 for now.

SWEDEN

Rune Wande SMØCQP
Frejavagen 10
S-155 00 Nykvarn
Sweden

YL World '91. Last year a group of Swedish YLs attended a YL convention in Hawaii, and decided to arrange a YL meeting in Sweden in 1991. This event, called "YL World '91," will take place in Stockholm, Sweden, during the midsummer festivities. By the time this is in print, the deadline for registration is probably past, but if you are going to be in the Stockholm area around June 20–23, you may call Kerstin SM5EUU, phone +46 21 33 04 85, for information. SKØYL will be active during this event.

International CW traffic net. The Scandinavian CW Activity Group (SCAG) was formed in 1974. The idea was to practice message handling. Some difficulties were encountered in the beginning because of different thoughts about third-party traffic. Our thinking was that handling messages about amateur radio matters between licensed radio amateurs could not violate any third-party traffic restrictions. Why wouldn't you be allowed to send a message to a ham operator through another ham operator? If you can talk with him or her directly, why shouldn't you be allowed to have a message passed to him or her? However, to forward a message to a person outside the ham ranks is not allowed here. *[Maybe changes will happen—Arnie.]* SCAG is running an international CW traffic net every Saturday at 1100 UTC on 14.065 MHz. Net control station is SK7SSK. See you there.

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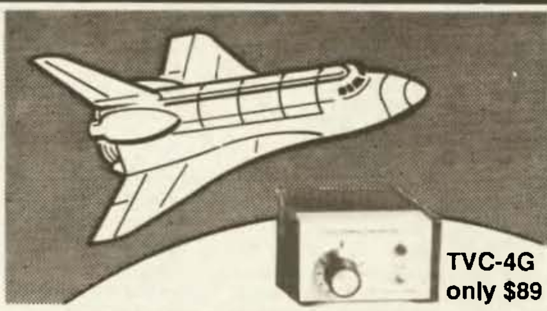

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ATV

Ham Television

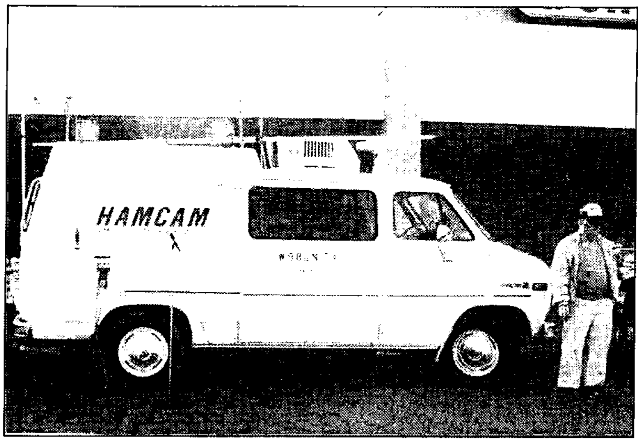

Photo A. The W8BJN HAMCAM ready for action.

Bill Brown WB8ELK
*%*73 Magazine
Forest Road
Hancock NH 03449

Take to the Road

Now that Field Day is approaching, you might think about taking your ATV station on the road. Each year a number of ATVers set up at Field Day sites and have fun exchanging pictures.

If you plan to operate ATV during Field Day, alert the locals and rack up a few new points. It's also a lot of fun to show those who decided to stay home just how much fun you're having (mosquitos don't show up well on video). Who knows, maybe a close-up camera shot of some of that fantastic food may convince some more folks to come out and operate! The ATV crew at last year's Nashua (New Hampshire) Amateur Radio Club (NARC) site spent a lot of time filming their complete on-site kitchen. That way they were close by when the next batch of goodies appeared. Not only did they have a full-sized electric range (they even baked cookies!), but they brought along a refrigerator stocked with ice cream. I understand that next year they'll include a kitchen sink!

A Field Day site is also a great place to demonstrate ATV to your club members and any visitors. A couple of years ago, we encouraged a number of area groups to bring out ATV to their Field Day locations. To ensure that they had something to watch, Mel Alberty KA8LWR and myself went up in his Cessna 172 to about 10,000 feet. We had a blast working several sites across Ohio and Michigan.

Portable Demos

You don't have to wait for Field Day to set up an ATV demonstration. Summer is a great time to put on a show at your local county fair or special event. Rod Fritz WB9KMO did an interesting demo for the Brooks Institute of Photography in Santa Barbara, California. He set up a link from the institute down to a nearby shopping mall via 434 MHz ATV. One of the students at the institute put on a skit about repairing appliances. Down at the mall, people crowded around the TV set to watch "Mr. Fix-It Man." Little did they realize that the fix-it man could see them via a 10 GHz link back up to the Institute. In the middle of his spiel he'd point at one of the audience and ask them a question. You can imagine the shocked reaction. Some pretty lively exchanges resulted, all done via a full-duplex ATV link.

If you plan to do a number of "road shows," you may want to organize your equipment to allow for a quick setup. Members of the Bayonne Emergency Management Amateur Radio Club (BEMARC) in Bayonne, New Jersey, have been giving demos to a number of area radio clubs. John WA2QYX, Danny N2EHN and Mike KB2EQQ have modified Danny's van for some portable ATV action. When they arrive for a club demo, they usually set up the van at a nearby interesting location, such as a busy intersection or shopping area.

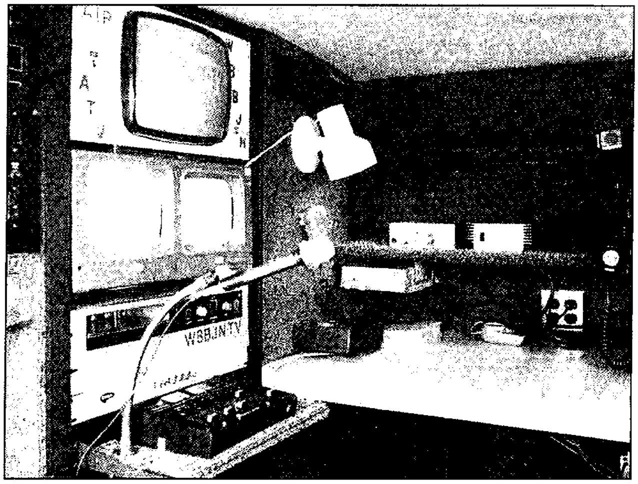

Photo C. Inside of the HAMCAM showing the ATV transceiver and 2m station nestled on shelves in the back of the van.

Mike KB2EQQ usually starts the ATV program inside the club and then has Danny and John transmit an outside view back into the clubhouse. Usually a few of the club members come out to be momentary TV stars. A few random interviews of innocent pedestrians may have the potential of a "David Letterman" style show. See "Hams with Class" in the February issue of *73* for more on the BEMARC club's activities.

If you plan on doing a lot of ATV road shows, you may want to build up your own dedicated minicam truck just like the commercial TV stations. Amateurs in central Ohio have done just that!

The HAMCAM

Gene Kirby W8BJN received an interesting offer back in July of 1989. A fellow ham who worked at a nearby commercial TV station (WBNS) explained that their station was retiring one of their RAPIDCAM remote TV trucks and wanted to offer it to the Union County Amateur Radio Club (Marysville, Ohio).

The club jumped at the chance, and proceeded to refurbish the aging vehicle. After a little body work and some fresh paint, they were ready to put in the radio equipment.

They installed a PC Electronics ATV transceiver (TC70-1) and beam antenna, video switcher, three rack-mounted video monitors, sound board, tape deck, VCR, amplifier and two video cameras. Next they installed a KWM-2 for HF, a 2 meter FM rig, a CB and a Civil Defense radio. They had a little room left over, so they threw in a scanner to monitor emergency service frequencies as well.

The completed HAMCAM has two operating positions. One is dedicated to HF communications and the other operates on ATV and 2 meter FM. Each position is designed for easy access to the equipment and is quite comforable for extended sessions due to the large plush chairs and air-conditioning (a heater is available during the winter).

Once at their destination, it just takes a few minutes to swing the antennas up to their operating position, set up the two TV cameras on tripods and put the HAMCAM on-the-air. After that, the operator uses his video switch panel to select between the two camera views and to watch any incoming ATV signals. The two camera views are continuously displayed on two of the monitors. The third monitor is used to receive ATV from a remote site or command center. They even have big floodlights installed on top of the van for night duty!

Emergencies/Demonstrations

The Union County club plans to use the HAMCAM to help out in emergencies, demonstrations, parades, fairs or anywhere a portable command station is needed.

You don't need an actual TV minicam truck to build your own HAMCAM. Good-sized vans can be obtained fairly reasonably if you're willing to do a little maintenance. It sure makes a good club project and can really help out your community in an emergency. 73

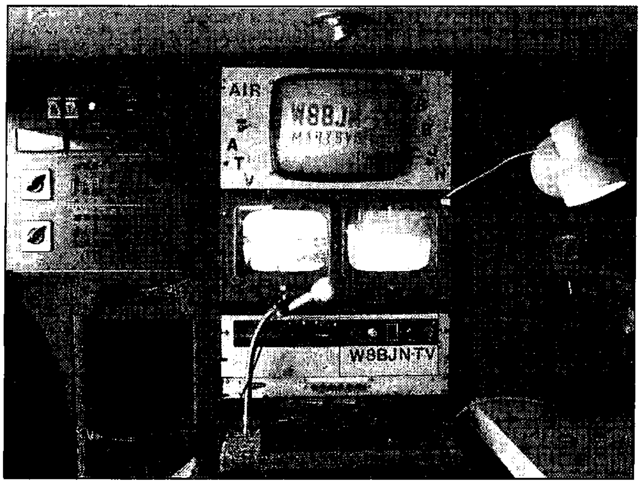

Photo B. The ATV operating position inside of the HAMCAM.

Number 33 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

I didn't think this topic would come up again, but it seems the debate over no-code is STILL raging. Can you believe it? Here we are, over four months after the first no-code Technicians received their licenses, and a large group of Neanderthals within our midst continue to bitch, moan, argue and predict the doom and demise of amateur radio.

Today I received a copy of a letter, sent to the FCC by an amateur radio club in California (I won't embarrass the members of this club by revealing their name), signed by the president of said club, listing all of the reasons why this particular group of geriatric amateurs was opposed to the no-code license. If these folks wanted to have their opinions heard on the matter, why did they wait until April to do it? Kinda' late now, boys.

To be sure, there are plenty of intelligent amateurs out there who have a problem with eliminating the code requirement. Some of the more interesting QSOs I've had in the last few months have been lively discussions of this issue. But having a well-formed opinion and expressing it with intelligence is worlds away from what I'm hearing on the bands—the same old stupidity, parroted over and over, by a bunch of old men who probably haven't touched their code keys in 20 years and couldn't pass a 13 wpm code test if their lives depended on it.

One more time, for the brain-dead, let's examine the major objections to no-code. Pay attention. This is the last time we are going to go over this.

"Having a code requirement maintains the quality of amateur radio licensees. If we eliminate the code, ham radio will become like CB." Anyone who has this opinion obviously hasn't spent any time on the bands lately. The goofballs on 14.313 MHz, the illegal and shameful behavior of many trying to contact the Bouvet Island DXpedition (or any even slightly rare DX spot, for that matter), 10 meters during a contest weekend, AMers on 40 meters with 20 kHz bandwidths (I have nothing against AM, but I have a lot of problems with 20 kHz bandwidths)... All of these folks (and these are but a few of dozens of examples) are licensed amateurs who have passed a code test. If you're a rude and obnoxious jerk, a code test is not going to change that. If you're a courteous and thoughtful operator, the lack of a code test will not turn you into a net-jammer.

"We must maintain the code requirement because code gets through when other modes don't. It's vital in times of emergency." This argument may have had some validity 50 years ago, but with modern communication modes and equipment it is simply no longer true. You can put up a dipole, pump less than 100 watts of packet into it and get an error-free message, anywhere in the world, delivered in less than 24 hours. And you don't even have to be in your shack to do it. You could send a message to yourself before you got on a plane from New York to Los Angeles, and the message would be waiting for you before your plane landed. If I had an important message to send, CW is the last mode I would choose. It's slow, inefficient and more prone to operator error than any other mode.

"Morse code is a radio tradition that should be saved. It's a useful skill that all radio operators should know." This is the dumbest argument yet, but you'd be surprised how many times I've heard it. Being able to shoe a horse is a useful skill, but I don't think it should be a requirement for obtaining a driver's license.

"The no-code license was pushed through the FCC by the major equipment manufacturers, so they could make millions of dollars in new equipment sales." Oh, how I wish this were the case. I have a very large streak of 1960s' "angry young man" in me, and this kind of a scandal would be perfect. Unfortunately, it just isn't true. I speak with the marketing managers of every major amateur equipment manufacturer on a regular basis—some of them I consider friends—and not once has any of them even brought up the subject of no-code. For most of these companies, amateur radio is a small sideline to their commercial electronics business. They are not sitting around waiting to make their fortunes off of amateur radio. The only people getting rich off of amateur radio are the ARRL (sorry... I couldn't resist).

"Unless you give these no-code Technicians special callsigns, how can we make sure they're not operating illegally?" Boy, the dopiness just keeps on comin'. I have a 1 x 3 callsign. If you hear me calling "CQ" on 15 meter SSB, how do you know that I'm not a Technician? You can look me up in the *Callbook*, but that information is at least four months old. I could have upgraded since the last edition was published. How do we know that any of us are really licensed to be transmitting where we do? I'm sure that hundreds of amateurs operate out of their allocated frequency privileges. I've even heard a few that I KNOW were operating illegally. So what? Most amateurs are like you and me. They respect the FCC regulations and operate according to their license class. Does passing a code test guarantee that you will only operate within your assigned frequency limits? No, of course not.

When you come across someone on your local repeater, or when the regular group of crotchety old farts on 40m starts up again about no-code, please do us all a favor and tell them to shut up. Amateur radio has changed. The rule passed. The no-code license is here. Get over it.

I've received dozens of letters from no-code licensees. Some have told stories of friendly local hams, welcoming them to the hobby. Others have had stories of rude and obnoxious idiots refusing to talk to them because they haven't passed a code test (no great loss—these dopes aren't worth talking to anyway). Most of these new licensees have mentioned that they are continuing to study the code, so they can get on HF.

Those of you who were around when the Novice license was first instituted will see a big similarity. Novices were shunned. The Novice class was going to be the demise of amateur radio. The same thing happened with Novice enhancement. Letting the Novices on 10m was going to be the end of amateur radio. Hell, the same thing happened when SSB was introduced... or 2m repeaters... or pick any change since the days of spark gap.

How you or I feel about no-code is a mute point. It happened. It's done. Now, let's all move forward and start addressing the real problems in amateur radio. If you insist on clinging to this non-issue, then the least you can do is keep it to yourself. The rest of us have more important things to do.

Number 34 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

Not Great, But Not Bad

Overall, June will be a fair month for DX, but not as spectacular as spring and fall. Sunspot Cycle 22 has begun to decline from its estimated peak in June 1989, and is now in its second downward year of an approximately six-year period when the sunspot minimum is expected (1995–96). DX will continue to be good to fair for the next couple of years, but you'll need more skill and information to maximize your success because opportunities will be fewer and farther between.

June always centers on the "DX Doldrums" because it marks the summer solstice, halfway between the spring and fall equinoxes when DX is best. The higher summer sun angle in the Northern Hemisphere heats the F2 layer, reducing ionization of the upper atmosphere. With the atmospheric noise levels and reduced ionization, DX opportunities are consequently reduced.

Although daytime DX will generally be poorer in June compared to winter, late evening DX may be better because of the longer hours of daylight. There are also VHF/UHF possibilities in June, and it's a good idea to look for sudden ionospheric and atmospheric disturbances that can promote them.

The expected poor days for this month will center around the 11th and the 22nd. The rest of June is expected to have poor to fair DX propagation conditions; but don't expect the results you get in spring and fall.

The charts may be used in two ways: To find an appropriate time and band to work the countries you need, or to take advantage of the operating hours you have available, and work those countries most likely to be open at those times. Then, consulting the daily calendar forecast, you can choose the days most likely to be best for success.

For more information about shortwave radio propagation, I recommend the *Shortwave Propagation Handbook*, by Jacobs and Cohen.

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	—	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	[illegible]
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20	20	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20	—	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	20	20	20	—	20	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20	20	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	—	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	—	—	20	[illegible]	[illegible]	—	—
U.S.S.R.	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

[illegible]

JUNE 1991

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G	3 G	4 G–F	5 F–G	6 F–G	7 F	8 F
9 F–P	10 P	11 P	12 P	13 P–F	14 F	15 F
16 F	17 F	18 F–G	19 F–G	20 F–P	21 P	22 P
23 P–F	24 F	25 F–G	26 G	27 G–F	28 F	29 F
30 F						

73 Amateur Radio Today

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LETTERS

From the Hamshack

Dan and Sue Cashin, Havertown PA As semi-regular readers of *73*, we'd like to let you know we find it an interesting publication. We especially enjoy your "Never Say Die" column. It's thought-provoking, interesting, and just plain good common sense!

We've been considering getting our ham tickets, but have not quite decided what the hobby will do for us. We're dedicated SWLers and enjoy the world at our fingertips. What is the hobby of hamming all about? Is it a world of contests, quick contacts, and QSLs? Is the soap opera we hear on 14,313 typical of ham nets? What types of nets are there? This is a high cost hobby, and we've not hit the lottery yet.

I'd like to propose an idea to go along with your new *Radio Fun* publication. Why not a net like ANARC's Sunday morning SWL net? There could be gateway stations to answer prospective amateurs' questions. It could serve as a place where interested people could get straight answers from people in the hobby. ANARC is on 7240 LSB, 10 a.m. East Coast time, with Bob Brown KW3F as net control.

Keep prodding and pushing for progress, and who knows, maybe we'll get to talk on the air some day soon.

Amateur radio is mostly about a half million or so people around the world who are having fun. Some do it with nets, talking to people with similar interests. Some chasing DX and fighting the pileups. Some with a hand transceiver on their belt, keeping in touch with friends in the area. Some in club work. Some in talking through our several satellites. Some in bouncing their signals off the moon. Some in building kits and designing new equipment. Some in microwave experimenting. Some in exchanging messages via their computers and packet radio. Some using radio teletype. Some with slow-scan TV. Some with regular fast-scan TV. Some send miniature TV cameras and transmitters up in balloons. Some get together on Saturdays and try to find hidden transmitters. Some get involved with contests. Some go to rare spots around the world and operate for a few days, making thousands of contacts. Some spend their time teaching newcomers. Some write long editorials. Amateur radio is a whole bunch of hobbies. Oh yes, some get their fun by getting on 14,313 and cursing out the others. Some send endless "information" bulletins on 14,275. One ham recently chose to try and mess up the DC police... and got arrested for his trouble. Our hobby has something fun to do for every temperament.

Money? It's easy to get once you get the hang of it. I find the harder I work, the luckier I get.... Wayne

Jeff Wilson N9IMJ, Carlinville IL I read your magazine regularly, and I can honestly say that it is the best magazine printed in the field of amateur radio. I especially enjoy your editorials, and in particular the ones that display a "get up off your duff and do something for your hobby" motif. Frankly, I'm as lethargic as the next person, but I cannot understand why any ham who is perfectly capable of it won't in some fashion attempt to better the hobby or promote amateur radio to the public.

The area in which I reside has quite a few amateurs, but very, very few active amateurs—ones who still have and use a radio. About a year and a half ago, eight of us active hams formed a club. Despite our small size, we have managed to organize Field Day in an area where the public could see us and ask questions. Every year we provide communications for the Multiple Sclerosis Walk-a-Thon. Our club gives demonstrations for interested groups, and lately we have offered a class in amateur radio to about 12 people. I can't speak for the others, but I know I put in 3–5 hours a week on the class alone, and if only one person passed the test, I would still consider it time well spent.

I realize all this isn't very much, but if a club of eight members can do this, a club with 200 members should be able to do at least twice as much.

Richard L. Collins WB4DBV, Camilla GA I thought I'd write you about these two stacks of magazines I have. One stack sits so nice on the shelf, and the other is a job to get organized. The one that sits so nice is *QST*, and the other is your *73*. Why? Now after many long hours of deep thought, I've found the answer. The *QST* is read once, and the *73s* are read and re-read many times over. Keep up the good work. TNX fer a great magazine.

Thanks for taking the time to write—and glad you're enjoying 73.... Wayne

Martin E. McCoy WB8TCZ/7, Cheyenne WY The last "new" magazine I subscribed to was some Timex/Sinclair rag that sent me two issues, then promptly disappeared from the planet. I'm not worried, though. You seem to have a knack for doing things right!

I'm signing up for your new magazine, and if it looks good, I'd like to get a subscription for High School III. High School III is an alternative high school here for kids who aren't able to remain in a "traditional" high school. I've visited HS3, and they look like a great bunch of kids who are making the best of what they have.

Their library is very pitiful—there is no Dewy Decimal 621 section (electronics). I'm going to try to rectify that, and even try to introduce some of the students to ham radio. Wish me luck!! Looking forward to your new mag!

Steven Rosenberg KC6FYL, Sherman Oaks CA I just wanted to drop you a note to tell you how much I've been enjoying *73* lately. I upgraded to General a few months ago, and I moved to an apartment QTH. April's issue was great. I built Frank KB4ZGC's "Artificial RF Ground," and now wonder what I did without it. The simple construction projects are great. From the April and May issues alone I'll be busy building for some time to come—I'm getting ready to put the Color Burst Ether Duster together for some mountaintop QRP.

Thanks for paying attention to apartment ops with articles on indoor antennas. May's "Apartment Antennas: A Challenge," was very helpful. You're definitely improving *73*, and I hope you keep the technical articles coming. I'd love to see a home-brew SSB rig—call me a glutton for punishment.

I hope the new codeless Technician license will bring a new kind of ham to the local repeaters, as well as a bunch of computer types to packet who wouldn't take the plunge before. I'm looking forward to *Radio Fun*—I hope it can do the job and help get a whole lot more people licensed and on the bands.

Oh, I used an Uncle Wayne tape for only a couple of hours and I passed the 13 wpm with no trouble and virtually no study. I didn't think it would work, but it's almost subliminal. I couldn't copy anywhere near 100% on the 20 wpm tape, but when the exam came, it was like a walk in the park! I don't know quite how it worked, but it did.

Glad the code tape helped... look for you on 20m now ... Wayne

Bill Pitts KC4WJG, Troy AL Recently my interest in amateur radio was rekindled, and I made a firm decision to get my ticket. The war in the Persian Gulf made me realize that electronic communications are still important, and I wanted to be able to do anything I could to help.

I passed the tests and made Tech, but I want to tell you that most of the people who become interested don't get their licenses. They become discouraged and lose interest. I think I have a very good idea why.

I had to travel 50 miles to find a ham magazine (*73*, of course)... about a week [later] I got a list of clubs in the area that offered exams. With a Radio Shack Novice and Tech theory book, which I also had to travel 50 miles to find, I studied for three weeks. The ARRL test was not exactly streamlined (it took three hours), but I passed on the first try.

While waiting for my ticket to arrive, I located two other hams where I work. One had retired and wasn't very active on the air. He told me about the local club, and I attended the next meeting. Guess what—there was no program and no planned activities, however there was a good discussion on how well the military operators could copy code during WWII. When the time came for the next meeting, I went to where the first meeting had been, but no one else was there. The location had been changed, and they thought everyone knew about the change. I had left my phone number with the club president. Since I didn't have my license, I couldn't ask anyone on the air where the meeting was. I had met two prospective hams at the first meeting who were studying for their no-code tests. They didn't pass. I wonder if I will see them again.

I have been reading *73* since the November issue. I really enjoy your magazine. The first thing I read is the letters, and the second thing is your editorial. I have to agree with you. There are a lot of people in amateur radio who don't want things to change. They may be nice guys, but they are behind the times. Perhaps I am passing judgment too soon, but no one has invited me to see their shack. No one has offered to let me listen in when they go on the nets, or shown me how their rigs operate. Is ham radio a closed society, or is it possible that most of the older hams are simply unaware of the needs of new hams?

I'm not giving up. I'm studying for General right now. I'm also studying your magazine. I want to build at least some of my equipment. I work for an aircraft manufacturer in the electrical and avionics fields, and I work with VHF and UHF radio regularly. I also have worked with computer hardware and software for many years. I taught myself to program in several languages. I can't wait to try packet and some of the other digital modes. What I'm trying to say is that I'm not stupid, and I think I could make a significant contribution to the local club, but they don't seem to care if I or anyone else gets a good start. If you could publish some articles dealing with simple receivers and transmitters, and some of the accessories to help operate the shack, I'm sure it would be worthwhile. If the old-timers won't teach us what to do, maybe your magazine will.

Bill, maybe we should start publishing the names of rotten ham clubs who are doing all they can to hurt amateur radio. We could also publish the names and callsigns of the club officiers. Maybe we can shame them into doing something... or at least get them to resign and let someone with a pulse take their position. Congratulations on getting your license. Look for me on 10m.... David N1GPH

J. Frank Brumbaugh KB4ZGC, Buffalo NY All authors appreciate comments and requests for additional information about their published articles, but those requesting such information should think about the cost of postage—not just for the one letter they hope to receive, but to consider that a number of other hams have also written the author for information—and enclose an SASE as an act of courtesy. The author's time and talent go into these replies, which he is pleased to do free of charge—but please, don't expect him to pay your postage bill as well. An SASE will guarantee a reply. I am 70 years old, living on very inadequate social security checks, and just can't afford to pay postage for those hams who want something from me but who lack the courtesy to enclose an SASE. I do not like to disappoint anyone, but I have to be realistic.

*Thanks for the reminder, Frank. All writers appreciate an SASE—*a self-addressed, stamped envelope. *When no SASE is enclosed, many writers do not answer requests.... Linda KA1UKM*

Tom Spellman KB8EOG, Leetonia OH I must confess, I enjoy *73*! The features on the latest equipment, the well-done projects. I would like to see some sort of goof-proof projects designed to help you learn something, so I can get my three kids involved more. They are primed by the things they see me do with amateur radio, and I catch them thumbing through *73*. They do ask questions. Yes, there are young people interested in ham radio. Yes, the children are interested in computers, science, and space. The middle child, 13-year-old Heather, did a science fair project on OSCARs. We can keep the hobby growing with a bit of encouragement to these kids.

Keep blowing the whistle on those lead-bottomed foggies who wouldn't share a frequency with a youngster even if they knew they would lose it because it isn't used (220).

Paul KI4CH, Chattanooga TN Just wanted to let you know how much I like your magazine. What I like are the articles on how to build it yourself. One of my favorite columns is "Above and Beyond." I've been a ham for about 22 years and have been wanting to get into working with microwave. Another column I like is "ATV." I'm happy to see that you don't use over half of your magazine writing about contests. Keep it technical, how-to, build-it-yourself. 73

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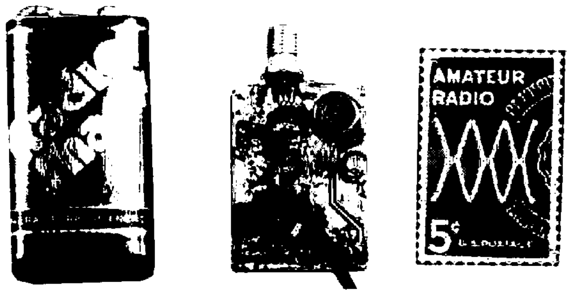
It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.



An ATV transmitter smaller than a postage stamp... see page 9.

Cover: The KH6HME VHF/UHF beacon site at the 8200′ level of the Mauna Loa volcano, Hawaii. Photo by Gordon West WB6NOA.

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Wayne Green W2NSD/1

License Fees?

First, thanks to all of you who sent me clippings from newspapers and magazines about the FCC's plans to auction off the spectrum to the highest bidders. Anyone like to guess what country starting with "J" will probably end up owning everything?

In line with this thought, the question of license fees for amateurs has reared its ugly head again. Yes, I know, the knee-jerk reaction is to fight furiously to keep getting the free ride we've been enjoying. After all, I can hear you trying to ask me seriously, don't we provide communications during emergencies? Yep, sure, sort of.

And don't we train people in technology so they'll be available during wartime? Come on, you don't really believe that old baloney, do you? We haven't been able to provide any useful fodder to the military since WWII, 50 years ago. Yes, we were extremely valuable then. But our ham gear today is so far behind in technology that it's pathetic. We're generations behind and falling further back every year. Heck, we've still got some old coots who honestly believe that CW still lives. Talk about fossils!

Heck, if any Gulf War communications equipment comes onto the surplus market, most of us wouldn't have a clue about what to do with it. What are you going to do with spread spectrum surface mount technology microprocessor controlled radios?

Let's not try and use bluster and exaggeration to keep from paying our share this time. In fact, I suggest we go the other way and not just endorse the idea of license fees, but ask the FCC for even higher fees than have been suggested.

Higher fees? The man's gone daft in his dotage. Hams pay money? Everyone knows hams are the cheapest, most miserly group yet to appear on this old earth. Every ham knows that hams long ago won the concept of cheap away from the Scots. I'm exaggerating? Oh yeah? Ask any ham dealer how much I'm exaggerating. Any of 'em. You'll hear war stories you won't believe of cheapness gone berserk. We're talking world class cheap. We're talking hams who will spend three days shuttling between ham dealers at Dayton to drive the price of a new rig down another two dollars.

Wayne's Proposal

Look, since several of you have begun to notice the lack of youngsters in our hobby, and I think that most of us will agree that socking a young newcomer with a high entry fee isn't too clever, I propose that we ask the FCC to not charge hams under 21 any license fee. That make sense?

Yes, I know, the kids today are sporting $100 sneakers, even though they've never even learned to tie the laces. Perhaps we should encourage "Sesame Street" to do a special on shoelaces.

And I see their expensive designer jeans (with the knees torn out). And their Nintendo games. But if you stop and think about it, the kids with the most money are those running drugs and may not be exactly the kind of kids we're looking for. Even if they did get ham licenses we wouldn't understand them over the air since they speak some strange dialect made up largely of one 12-letter word.

The FCC, to simplify their tremendous work load (am I being sarcastic?), now deals out 10-year licenses. That's okay with me. Now I can forget to renew my license every 10 years instead of every five. But that tends to escalate any nominal yearly license fee into fairly large numbers.

I don't think any of us who are actually using our license would argue that we get $100 worth of enjoyment out of it a year. But lordy, that's $1,000 for 10 years. Holy moly! Panicsville.

A $3-a-year fee has been proposed. Well, since I'm suggesting that we let the kids in free, how about the rest of us ponying up a crummy $5 a year to make up for the difference? That's $50 for 10 years. That's about what a dinner for three costs if one person doesn't eat. Even cheapskates like me find a lunch for four goes over $50. Maybe it's the dessert that does it.

Even retirees should be able to eke out $50 for the privilege of irascibly driving the rest of us bananas with their endless exposing of the vacuity of their lives for the next 10 years.

Perhaps we should put in a proviso that our widows can apply for a refund for the unused portion of our fee in case we win our treasured Silent Key certificate before our license runs out. I had a letter from an XYL saying her husband had died that morning and she'd like a refund on his *73* subscription.

What to Do

This is the hard part. It means you've got to find someone you know who can write and get them to do some letters for you to sign urging the FCC and the appropriate senators and congressmen to make that a $50 fee for 10 years, with no fee for anyone under 21. I'd suggest you write the letters yourself, but I've been asking you to write to me for more than 30 years and I haven't heard from you yet, so it's obvious that . . . etc.

Of course I realize that, since you agree with me 100% of the time, there isn't any real urgency in your writing. After all, as long as I don't hear from you, I'll know that you are in total agreement with me. Right? Yes, I truly believe that. Nothing else makes any sense.

The FCC's Secretary gets mail at Washington DC 20554. Your senators and the senators on the subcommittee involved with this mess, Ernest Hollings (D-SC) Chairman, Daniel Inouye (D-HI), Dale Bumpers (D-AR), Frank Lautenburg (D-NJ), Jim Sasser (D-TN), Warren Rudman (R-NH), Ted Stevens (R-AK), Mark Hatfield (R-OR), Robert Kasten (R-WI), Senate Office Building, Washington DC 20510. Reps. Neal Smith (D-IA) Chairman, Bill Alexander (D-AR), Joseph Early (D-MA), Bob Carr (D-MI), Allan Mollohan (D-WV), Nancy Pelosi (D-CA), Hal Rogers (R-KY), Ralph Regula (R-OH), Jim Kolbe (R-AZ), House Office Building, Washington DC 20515.

The easy approach is to write your letter on a computer and then just change the salutation as you print it out for each senator or congressman. Oh yes, please run off an extra copy of your letter for me.

Living Longer

Lost some of your zest for amateur radio? Maybe it's time you got out of your old rusty rut and tried something new? Even the best of things get old after a while. Yes, even sex . . . unless you find a new partner. That seems to perk up even the oldest of codgers. It sure upsets their wives, though.

You know as well as I that it's having interests and goals that keep you alive. This is why so many men die shortly after retiring . . . retiring to enjoy their "golden years." Some gold. They should be called the wooden years, because that's the box they're in . . . or else a small vase on their widow's mantel.

Through *73* I can lead you to water, but I can't make you drink, no matter how much I hoarse around. Or hearse around. We can run articles telling you how much fun packet is, but we apparently can't get you to give it a try. Ditto slow-scan, RTTY, moonbounce, DXpeditioning, QRP, and so on.

Right now the biggest need our hobby has is not for you to keep yourself alive, mumbling inanities endlessly on 20m and begging for QSLs. It's to adopt a youngster and exercise your atrophied elmer muscles. We need a serious attack of mentoring.

Don't just sit there limp and jelly-like. Get some fire in your endocrine system. Call the principal of a local school and see if they have a program for people to come in and talk with their students. And if not, why in the hell not? Then go in and talk to the kids about amateur radio. Get 'em excited. And even better, offer to help 'em get their licenses.

We've got something over 400,000 licensed hams who seem to be at least partially alive . . . of which maybe half are even remotely active. I define "active" as being able to find a rig if pressed by a phalanx of steel-eyed, armed FCC inspectors.

It's no wonder we're seeing our ham bands being used more and more by criminals to make their operations easier. What's more secure these days than our ham bands? The Medford (MA) police (none of them hams) used 2m HTs to rob banks and stores. I guarantee we're not using our bands much. Heck, I take my 2m HT along when I travel and call in on every repeater I can find. I'll bet I get an answer on one out of 10. Phooey.

What little activity we have today seems to be concentrated in DX pileups on the low bands, where a couple dozen DXers spend their evenings jamming each other to get a QSL from some exciting place like London or Paris.

Lloyd and Iris are going strong, going from country to country on what seems to be a lifetime DXpedition. The only pity there is that they so seldom write to share their exciting adventures. The next time you work them, see if you can get in a couple words between your call and their signal report to suggest that they should at least take a few minutes a day to write something to help get kids interested in the hobby.

I've DXed from enough rare locations to know that every country visited holds a fascinating story. Did I tell you about my visit to Western Samoa, where I operated 5W1AZ? Did I tell you about how the natives will promptly kill you if you hit one of them with a car? And how they walk in difficult-to-dodge bunches down the middle of the only road on the island at night? Did I tell

Continued on page 68

QRX . . .

Packet Challenge

On January 25, 1991, the FCC sent violation of Part 97 notices to 11 amateur packet operators, fining several of them $300 for allowing the dissemination of a message allegedly posted by Joseph L. Reed WA3QNS of Norristown, Pennsylvania, on the N3LA/Rolf Jesperson BBS in Spring City, Pennsylvania.

The message publicized a 900 telephone number and urged readers to call the number to register opposition to the war in Iraq. The message did not mention a reported $10 charge for using the 900 number. Amateur operator Russell "TJ" Tjepkema of Virginia Beach, Virginia, believed the message was a business communication outlawed under Section 97.113(a), and reported the matter to the FCC in Norfolk, Virginia.

J. Jerry Freeman, FCC Engineer in Charge of the Norfolk field office, issued the citations "after consulting with many others." Until then, most amateurs believed that only the originator of a prohibited transmission was responsible for message content. Such is not the case, says Freeman: "...the amateur rules provide that the licensee of an amateur station shall be responsible for its proper operation.... Section 310(d) prohibits a radio station licensee from giving his or her license or any of the rights conveyed by the license, to anyone else...." Freeman emphasized that the FCC licenses individual amateur stations, not systems or networks, and that all amateur service rules apply to each amateur station even when it is operating as part of a system.

More than 50 petitions have been filed with the FCC, seeking clarification of responsibility for messages sent through digipeaters, packet bulletin boards, and voice repeaters. As of April 26, four had been formally accepted for commentary.

Packeteers and sysops of BBSs are worried that if every message has to be evaluated before transmission, it will mean the end of packet as we know it. Although Freeman has seemingly backed off a bit by canceling the fines—and In most cases dismissing the charges against BBS operators who have taken corrective action—some angry packeteers are seeking to oust Freeman from government employment.

Freeman W4JJ, an Extra Class amateur himself, says, "Amateur radio operators are very resourceful. As I said before, they may not abdicate their responsibilities, and I believe they will come up with a system which will be able to prohibit dissemination of unauthorized traffic." When asked about the negative effect having to manually evaluate each message for content would have on the amateur's ability to handle traffic, Freeman replied that, "An amateur who retransmits a business or prohibited message is violating the rules. If there is an emergency, their procedures could be changed...they could have various degrees of readiness." TNX *W5YI Report, Vol. 13, #9*, and *Westlink Report, Nos. 600* and *601*.

It's Official

Amateurs must be **off** 220–222 MHz by midnight, **UTC** on August 28. That's 8 p.m. Eastern Daylight Time on August 27. The FCC issued its final Report and Order in PR Docket 89-552 on April 29. At that time, it also adopted rules for the use of 220–222 by the Private Land Mobile Service.

Basically, the FCC has divided the 2 MHz slice of spectrum into 400 five kHz-wide slots to create 200 narrowband channels. Ten of these will be reserved for government use. UPS will be the main beneficiary of the new channels.

The Eastern VHF/UHF Society is having a "transition night QSO party," henceforth to be known as "The 220 QSY QSO Party" to mark this "ending and new beginning." It will be in two phases, two hours before and four hours after the change. For complete rules, send an SASE to the Eastern VHF/UHF Society, Thomas J. Kirby W1EJ, 1 Meadow Knoll, P.O. Box 455, Pelham, NH 03076. TNX *Westlink Report, No. 601, B-N-T Bulletin, Vol. 19 Issue 5*, and the Eastern VHF/UHF Society.

Recognition of PRB-1

The Florida Legislature passed HB-203/SB-598, reaffirming federal guidelines in PRB-1. Passage of this bill, which became law on April 28, makes Florida the first state in the nation to recognize PRB-1, the FCC's Private Radio Bureau declaratory "Memorandum Opinion and Order," issued on September 19, 1985. In part, PRB-1 states that "State and local regulation of a station antenna structure must not preclude amateur service communications. Rather, it must reasonably accommodate such communications, and must constitute the minimum practicable regulation to accomplish the state or local authority's legitimate purpose."

Section 166.0453 of the Florida bill covers amateur radio antennas. It forbids local governments to enact unduly restrictive antenna ordinances that do not conform to the limited pre-emption titled "Amateur Radio Pre-emption, 101 FCC 2d 952 (1985)," also known as PRB-1.

ARRL Northern Florida Section Manager Rudy Hubbard WA4PUP originated the idea of pushing for a state law recognizing PRB-1. ARRL State Government Liaison John Hills KC4N of Tallahassee pursued Rudy's idea of asking Hurly Rudd, a neighbor and legislator, to introduce HB-203 in the 1991 session. Many Florida hams wrote, phoned, or telegrammed their district representatives, while Southern Florida ARRL Section Manager Dick Hill WA4PFK and staff pushed hard, too.

Adding to the fervor was a prosecution in Orlando of a ham who violated a blanket 25-foot tower limit under a theretofore ignored Orange County ordinance passed in 1979. According to Rudy, officials held further action in abeyance pending the outcome of HB-203/SB-598.

While future antenna restrictions are not totally banned, local politicians will be slower to think of them in the future. The legislation does not affect private contracts, such as land covenants and deed restrictions. Home and land buyers should research such restrictions before closing on a sale. TNX *Balanced Modulator, Vol. XXVI, No. 5.* TNX also Jim McMillan for sending us an early article on the proceedings. Referenced also was the ARRL's *FCC Rule Book*.

Bigger and Better

The best guess is that well over 35,000 people attended the 1991 Dayton Hamvention. The official attendance was 32,716, which didn't include several thousand youngsters who were admitted free to introduce them to amateur radio. That this 40th edition was bigger and better than ever—12% larger than last year—is a good indication that amateur radio is indeed alive and thriving.

More than $110,000 in prizes was donated by the amateur industry and awarded to lucky ticket stub holders. There was a separate prize drawing for the young people who were admitted free. One conventioneer won an ICOM IC-2SAT in an unusual way: He turned in $1,700 that he found in a folder with no identification. Earlier, however, the money had been reported as lost. Though it wasn't ICOM who lost the money, the firm wished to applaud WA8OKA for his honesty.

The first Hamvention took place in 1951 at the Dayton Biltmore Hotel. Six hundred people showed up to inspect the wares of seven exhibitors and to attend six forums. This is a far cry from 1991's three hundred plus exhibitors and 51 forums on diverse subjects.

In 1964 the Hamvention moved to Hara Arena, where it has been held ever since. New this year were large tent-booths for flea market dealers who couldn't obtain a commercial booth inside the center. Even though there were more sellers than ever, it was a sell-out. TNX *W5YI Report, Vol. 13, Issue #10.*

Help Save Our Bands

Write your congressmen in support of H.R. 73, the Amateur Radio Spectrum Protection Act of 1991. Introduced by Congressman Jim Cooper of Tennessee, a member of the House Committee on Energy and Commerce, this amendment to the Communications Act of 1934 would help prevent further

QRX . . .

Photo A. One of the most frequently heard voices in the Milwaukee, Wisconsin, area is that of Theodore Maddox WA9QQJ, recipient of a Good Guy Citation for his work with Novices. You may have heard him handling traffic when he was active with Navy MARS, too, call N0HEL. After the Navy, Ted joined a CBer's club in order to teach ham radio to CBers, which he did with great success. We salute Ted for his contribution to ham radio.

loss of our amateur radio spectrum. (See the March "QRX" for more details if you wish.) Tell your Congressmen that Jim Cooper has authored H.R. 73 to prevent further erosion of frequencies allocated to the Amateur Radio Service. You might mention that there are nearly half a million hams nationwide. Include the number of hams in your county or state, since this means potential votes. TNX Art Smith W6INI and *Counterpoise, Vol. XXXIII, No. 5.* Excerpt from article.

News from *Mir*

To help expand manned amateur radio in space activities, ICOM and PacComm recently donated gear to the Soviet space station *Mir*. According to Soviet amateur radio space operations coordinator Boris Stepanov UW3AX, the ICOM IC-228 2 meter FM transceiver and the PacComm "Handi Packet" TNC unit are already in orbit.

British astronaut Helen Sharman is presently being briefed by UW3AX on *Mir* amateur equipment operation. At the date of this writing (May 16) she was expected to launch around May 18 and rendevous with *Mir* a couple of days later. Operating from *Mir*, she was to use the callsign GB1MIR/U. If all went as planned, by now Helen would have contacted nominated schools in the United Kingdom, giving the results of and observations on various experiments being conducted aboard *Mir*. Undoubtedly there will be future opportunities to listen in on the 144 MHz contacts. TNX *Westlink Report, Nos. 600* and *601;* and John A. Magliacane KD2BD, CompuServe Space News

Tiny Cameras

The size of a thumbnail? According to an article in the April 25, 1991 *Wall Street Journal*, researchers at Edinburgh University in Scotland have developed a single computer chip that incorporates all the circuitry needed for a video camera. It does both light sensing and signal processing. Even with the lens that fits on top of the chip, it is still only the size of a thumbnail. When they become available, they may cost as little as $40 each.

While the researchers only envision its use in automatic teller machines for security, other people see more exciting possibilities, such as baby monitors, picture telephones, bar code readers, robotic vision systems, rocketeering, ballooning, and yes—you guessed it—ham amateur television, or ATV. *TNX Miles Abernathy N5KOB.*

Calling Ham Scouts

If you've combined amateur radio with Boy Scout/Explorer activities, Hal Camlin W3QLP would like to hear from you. With the help of the Baltimore Area Council of Boy Scouts, he is writing a book, the *Scouting and Exploring Ham Radio Manual*. Write Hal Camlin W3QLP at BSA Post 73, 7506 Jacquill Road, Glen Burnie MD 21061-3812. TNX *W5YI Report*, Vol. 13, Issue #10.

Writers Wanted

Radio hobbyists who like to write, and writers who are radio hobbyists, are being sought by Tiare Publications. Tiare is interested in developing new titles in all areas of amateur radio. If interested, ask for a copy of the Tiare "want list" which is available for an SASE. TNX Tiare Publications, P.O. Box 493, Lake Geneva WI 53147.

Photo B. Five-year-old Veronica Harrington KC6TQR of Long Beach, California, passed her Novice exam last April. Currently, she's studying for her Technician upgrade so she can get on the local 2 meter kid's net. Veronica also enjoys 10 meter voice. Her mom, Ann N6YGP, and dad, Curt N5HMR, helped her learn code and theory. Her other interests are ghost stories and vintage horror films.

Micro ATV Transmitter

Can the Dick Tracy video wristwatch be far away?

by Mike Henkoski KC6CCC

Ever think about going pedestrian mobile with ATV from your shirt pocket? If so, here's a project that will enable you to do just that! Thanks to the availability of a new packaged oscillator produced by RF Monolithics, Inc., of Dallas, Texas, the dream has now become a reality.

Most non-synthesized methods of transmitter design for VHF and above require the use of frequency multiplier stages in conjunction with standard crystals. Physical limitations placed on the crystal are such that fundamental frequencies over 20 MHz are not practical, due to the fragile nature of the quartz wafer.

There is, however, another way of gaining higher oscillation frequency using the same quartz material: Use a SAW (Surface Acoustic Wave) resonator. A SAW resonator is formed by placing a pattern of metal reflectors on the surface of a quartz substrate. Using this method, oscillation will occur at much higher frequencies than by conventional means, and you'll be able to achieve fundamental frequencies of more than 1 GHz. This resonator, when combined with microchip technology, will provide a packaged oscillator capable of producing over 5 milliwatts of continuous output in the UHF 70cm ATV band.

Normally, the cost to engineer and produce this type of device would be prohibitive to the amateur radio community. However, as luck would have it, the ATV segment of our band in Germany is used for license-free devices such as car alarms, garage door openers, etc. In looking through the spec sheet from RFM, I noticed that one of the frequencies they produced for the European market was nearly right on top of the 434.00 MHz ATV frequency (see Photo B).

Because of the frequency involved, and the small size of the components used, this project may prove difficult for beginners. Use of SMD (Surface Mount Devices) helps to lessen the effects of stray inductance and capacitance, but the small overall size of the project may still be a real challenge. Some standard components were used in noncritical areas. The primary goal was to end up with a stable and reproducible design.

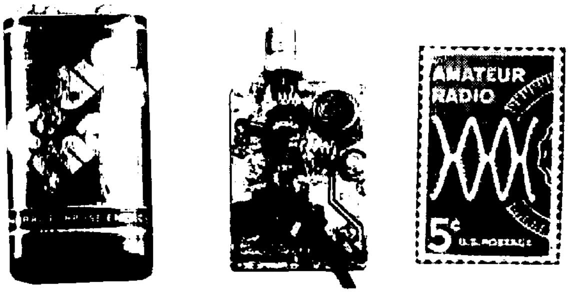


Photo A. The assembled micro TV transmitter.

A Few Tips About SMDs

You have to be able to see it to work with it—use of a magnifier of some sort may be helpful. Sharp tweezers are a must.

Use a small pencil-tip soldering iron with about a 35 watt rating. Make sure the tip is kept clean, and don't linger on the components too long.

When installing a component, tin the pad area lightly, position the component, then tack one side into place. Check the position, then solder the other side. Apply gentle downward force to the component to maintain position. *[Ed. Note: Before you tackle the micro ATV board, you may want to get a bag of SMD resistors from Radio Shack and try your hand at soldering a few practice components on a scrap piece of PC board.]*

Take your time. Fortunately, the parts count is not very high—I assembled the first unit in about two hours.

If you wish to etch your own board, remember that feedthrough positions are not all reflected on both halves; some are on one side, the remainder are on the other. Drill all the holes indicated on both sides independently.

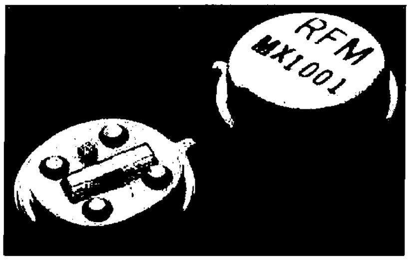


Photo B. The RF Monolithics SAW oscillator module. (Photo courtesy of RFM.)

The winding and placing of the coils require special attention. The closer the coils are made to the dimensions indicated, the easier the tune-up will be.

What Does What

The heart of the micro ATV transmitter is the Micro Transmitter Module by RFM. It consists of a SAW resonator, along with associated circuitry—all contained within a 5-lead TO-39 package.

The device has a maximum rating for the supply of no more than 10 volts, and a power output rated at +7 dBm, or 6 mW. *[Ed. Note: The micro-TV transmitter is designed to operate from a 9 volt battery (7–10 volt operating range). If you plan to use a power supply greater than 10 volts, you must use a voltage regulator IC to drop the voltage below 10 volts.]*

Pin 2 is provided for external modulation input, but for this project it is unusable because the maximum modulation rate allowable is 50 kHz. This pin is tied high through R1 and bypassed by C1. Pin 3 is available for power output adjustment. The value of R2 is set at 33k to allow maximum output power. Pin 4 is VCC with Pin 1, connected to the junction of L1 and C2, providing output tuning. C3 and C4 provide for proper RF bypassing of U1.

The output at L1 is coupled to the secondary L2 which feeds the base and bias network. C3 provides impedance matching to the base of the amplifier/modulator Q1.

Output to the antenna from Q1 is provided by way of matching network L3 and C4. L4, C5, C6 constitute a low-pass network ensuring adequate suppression of the 2nd harmonic (35 dB down). R5 lowers the Q of L3, which provides for greater stability of Q1 for changes in VSWR at the antenna. R5 also serves, together with C7, to block RF from entering the modulator. C10 through C13 provide additional bypassing of the power supply.

The modulator consists of R6 used to match R7 video gain control to the incoming video impedance of 75 ohms. If a 100 ohm value for R7 was available, R6 would not have been necessary, but it's difficult to find chip pots less than 500 ohms. C7 provides DC isolation and impedance matching to the base of video amplifier Q2 and pedestal clamp D1. Vari-

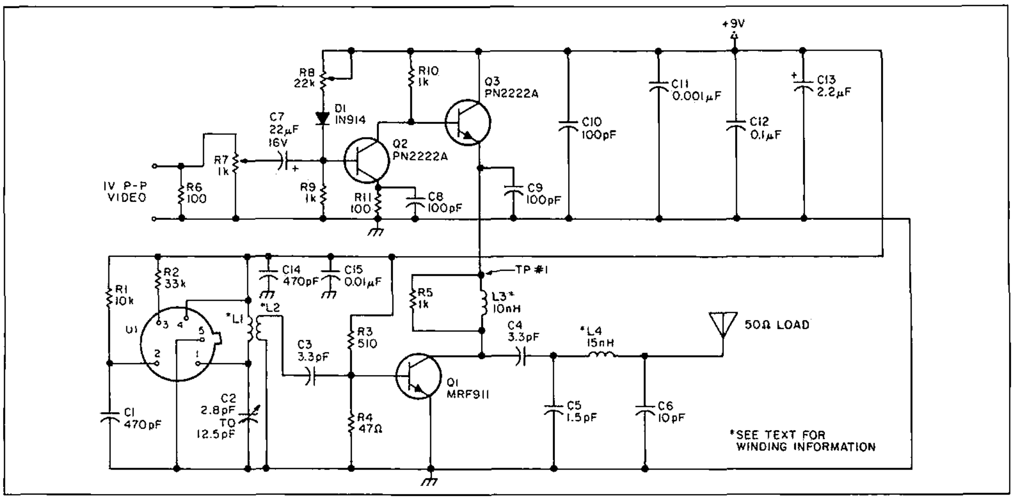


Figure 1. Schematic diagram of the micro TV transmitter.

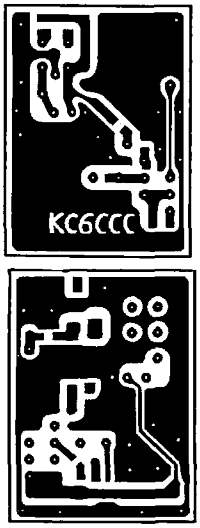


Figure 2. PC board foil patterns. (a). Bottom layer. (b). Top layer. Use a #74 size drill bit for all holes. Be sure to solder jumpers between the top and bottom layers where indicated for efficient grounding.

able resistor R8 sets the proper pedestal clamping and restores the DC level. Without clamping and DC restoration of the video waveform the sync pulse amplitude tends to change with variations of scene illumination. This has the undesirable effect of loss of sync and tearing of the picture.

Resistors R9, R10 and R11 provide proper bias and gain set for Q2. Capacitor C8 serves to boost the high frequency response of Q2 to allow for good resolution and color saturation. Transistor Q3 serves as an emitter follower modulator stage.

Transistor Q1 is run at only 25% of its maximum to ensure low intermod products and also to avoid compression of the horizontal sync. Heat-sinking is accomplished by contact with the PC board clad.

Coil Winding

Coil winding is simplified by using machine screws of the proper size and thread as forms. The wire used may be either insulated or not. I used 24 guage bare tinned wire (available from Radio Shack) on mine because you don't have to strip the coating. Wind each coil tightly on the form and bend the leads to shape while it's still on the form (to avoid distorting them).

Assembly

Install all SMD chip components first, caps and resistors. Then install transistor Q1, making sure to pre-trim the leads first. Leads only need to be about 1/16" long. The collector is the longer of the leads. When trimming to size, cut the collector at a slight angle to differentiate it from the others.

After prefitting the transistor onto the board, place a small amount of heatsink compound underneath. All that is needed is a 1/32" dot—too much may make soldering the leads more difficult than necessary.

Next, install all the coils, starting with L1. Solder L2 onto the ground plane on one side, then C3 at the other. The final position of L2 should be such that L1 and L2 appear to be one continuous coil as viewed from directly above. If the two are too far apart, there may not be enough coupling between them.

Install Diode D1, then transistor Q2. Now all the remaining components can be installed. Solder the battery clip leads to the board, observing the proper polarity. Use mini coax to connect the output to the antenna dummy resistor. Also use coax to connect to the video-in on the board. Connect the other side to the female RCA.

Tune-Up

Now we are ready for the final test and tuning, but before continuing use an ohmmeter to check the resistance of the circuit through the battery clip. It should be no less than 400 ohms. If it is, *stop now* and check for shorts.

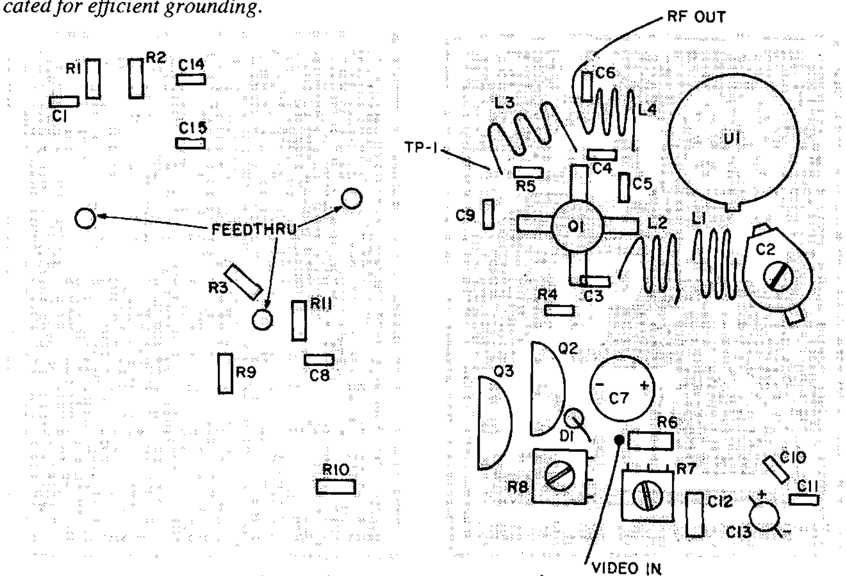


Figure 3. Parts placement: (a) Bottom side. (b) Top side.

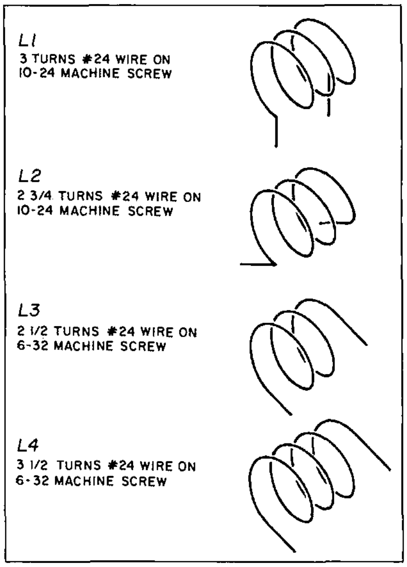


Figure 4. Coil winding details.

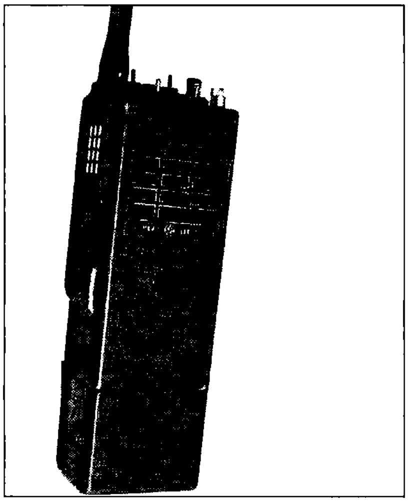


Photo C. Build your own "Lookie-Talkie". The micro ATV transmitter and a GBC CCD-100 or a Micro Video Products micro-TV camera can be easily mounted in an old 2 meter HT case. Note camera lens in center.

Connect a 47 ohm ¼ watt resistor with short leads (dummy load) between the antenna output and ground. Connect a standard 1 volt peak-to-peak video input. Connect an oscilloscope to TP-1, the modulation input to Q1. Apply power to the transmitter. Adjust pots R7 and R8 for 6.5 volts peak-to-peak video at TP-1. What we are trying to do at this point is set the waveform right between the positive rail and ground without compressing either the whites at the bottom or the horizontal sync at the top. The DC level at TP-1 should be approximately 3.3 volts with a 9-volt supply.

Next, adjust C2 to give maximum power output using an RF voltmeter placed across the dummy load. A standard DC voltmeter could be used to adjust the power out by inserting a 1N914 diode between the multimeter and the hot side of the dummy load resistor. Connect the anode of the diode to the load and the cathode to the plus lead of the meter. Adjust for the maximum voltage indication. An alternate method of adjustment would be to use a signal strength meter or wattmeter. Most wattmeters will give some sort of usable indication for peaking.

Remove the dummy load resistor and connect the transmitter to a 70cm antenna—I use an HT rubber duck from my handheld—and observe the picture. You may wish to make some minor adjustments to R7 and R8 at this point.

The peak power output (as indicated on a spectrum analyzer) has been between 80 and 100 mW at the horizontal sync tip. Remember, power meters don't indicate in the same manner, so power output as measured using a meter may be somewhat less. If you have a spectrum analyzer available, you can fine tune by expanding or compressing the coils. Be careful not to short the windings.

Note: Some parts of the country use 434.00 MHz as a repeater input. Please check with the ARRL repeater directory to see if there are any ATV repeaters that may be affected by your transmissions when operating ATV from R/C aircraft. Most ATVers use a 2 meter simplex frequency for coordination of activity. Some of the more common frequencies are: 144.34 (Midwest), 145.17 (Phoenix), 146.43 (West Coast) and 147.45 MHz (parts of Ohio). Check the local activity before you transmit so as not to interfere with other ATV transmissions. Also, other local ATVers will enjoy flying along with your R/C plane if you alert them. Test flights have shown that interference to even weak stations can be minimized by maintaining a distance of at least 15 miles from an ATV repeater.

There are many uses for the micro ATV transmitter. My favorite happens to be flying it in model aircraft. I have also taken one of these transmitters aloft using a kite, and I've even attached one to a model RC car. There have been numerous balloon launches using ATV as a payload. This micro package, used to drive an SAU4 brick-type power amp (such as a PC Electronics PA-5), would make a nice payload. You could also build your own "Lookie-Talkie". Mike WA6SVT put one in a 2 meter HT case along with a micro TV camera (see the Parts List for camera sources) and had a blast carrying it all over the Dayton hamfest (see Photo C). Bring along a pocket LCD TV and you now have instant 2-way video communications in a very compact and portable package. Have fun. ■

Contact Mike Henkoski KC6CCC at PO Box 3464, San Clemente CA 92672.

Parts List

Part	Description	
All resistors are surface mount type, ⅛ watt, 5%.		
R4	47Ω	Radio Shack 271-313
R6,R11	100Ω	Radio Shack 271-313
R3	510Ω	Mouser 260-511
R5,R9,R10	1kΩ	Radio Shack 271-313
R1	10kΩ	
R2	33kΩ	
R7	1kΩ surface mount pot.	Mouser 321-3100-1K
R8	22kΩ surface mount pot.	Mouser 321-3100-22K
L1-L4		See text for winding info
All capacitors are surface mount type NPO, 50 V unless otherwise specified.		
C5	1.5 pF	Mouser 140-CC501N1.5C
C3,C4	3.3 pF	Mouser 140-CC501N3.3C
C6	10 pF	Mouser 140-CC501N100D
C8,C9,C10	100 pF	Mouser 140-CC501N101J
C1,C14	470 pF	Mouser 140-CC501N471K
C11	0.001 µF	Mouser 140-CC501B102K
C15	0.01 µF	Mouser 140-CC501B103K
C12	0.1 µF	Mouser 140-CC502B104K
C2	2.8-12.5 pF trimmer	Mouser 24AA071
C13	2.2 µF, 16V tantalum	Radio Shack 272-1435
C7	22 µF, 16V tantalum	Radio Shack 272-1437
D1	1N914 diode	Radio Shack 276-1122
Q2,Q3	PN2222A NPN transistors	Mouser 592-PN2222A
Q1	MRF911 NPN transistor	RF Parts, Inc. or ECG63
U1	MX1020	SAW oscillator (RFM)
Misc. parts:		
2′	#24 solid wire	Radio Shack
1	9V battery clip	Radio Shack 270-325
	Mini coax RG-174 type 50Ω	Belden
1	Female RCA phono plug	
1	Female SMA connector (optional)	E.F. Johnson 142-0701-201 or equiv.

Kits or Assembled/Tested:

A complete kit including SAW oscillator, blank PC board and all components is available for $89 ppd. from Elktronics, 12536 TR 77, Findlay OH 45840. (419) 422-8206. Also available as separate items are the blank PC board ($19) and the 434 MHz SAW oscillator ($30).

Assembled and tested micro ATV transmitter boards (catalog #ATVM-70) are available for $119 from PC Electronics, 2522 Paxson Lane, Arcadia CA 91007. (818) 447-4565.

Please include your callsign with your order.

TV camera sources:

GBC CCD-100 miniature TV camera
CCTV Corp., 315 Hudson St., New York NY 10013, (800) 221-2240.

Micro-Video Camera
Micro Video Products, 1334 Shawnee Dr., Santa Ana CA 92704.
(800) 473-0538 or (714) 957-9268.

Parts sources:
Mouser Electronics; (800) 346-6873.
RF Monolithics, 4441 Sigma Rd., Dallas TX 75244. (214) 233-2903.
RF Parts, 1320 Grand Avenue, San Marcos CA 92069. (619) 744-0700.

Tropo Time is Now!

Talk thousands of miles on the VHF/UHF bands.

by Gordon West WB6NOA

Hooking up with a repeater 300 miles away, direct, on FM, is often possible during the summer and fall months. If you own a VHF or UHF mobile or base unit with SSB capabilities, your long-range contacts on what are normally short-range frequencies can really get exciting. And if conditions are just right, you can access an FM repeater over a thousand miles away! Imagine that.

Photo A. The KH6HME beacon site at the 8200' level of Mauna Loa volcano, on the big island of Hawaii.

The phenomenon for long-range VHF/UHF and microwave DXing is called tropospheric ducting. But don't confuse "tropo" with E-layer skip (Es), which may only last for a few minutes on 2 meters. The latter is the result of ionospheric reflections from high altitude, densely ionized clouds caused by wind shears. Tropospheric ducting, created by temperature inversions, may last for days and sometimes even weeks.

Super Mirages

Picture the tropospheric duct as an inverted mirage that occurs in the atmosphere above us. You've all seen a mirage, where you look DOWN the road and see the shimmering blue sky refracted from ABOVE by the sharp boundary layer of hot air lying inches above the ground. In a tropospheric duct, a sharp boundary of hot air associated with a high pressure system sits above us, causing VHF and UHF signals to refract along the bottom side of this layer, which might hug the horizon for over 2,000 miles!

In rare instances recorded in Santa Barbara, California, and Key West, Florida, the tropospheric duct became so extensive that observers reported seeing distant land masses appearing upside down, shimmering, out at the horizon! This optical super-refraction is the same atmospheric phenomenon that lets you see the glow of the big city lights hundreds of miles away, and also lets you receive TV channels from three states away! This usually happens in summer and fall.

The VHF and microwave radio horizon is generally 4/3 the visual horizon. The slight bending, or refraction, of straight-line VHF/UHF and microwave frequencies is similar to the bending effect you see when you put a rod in a glass of water. The refractive index of water is different from the refractive index of air, however.

Under normal weather conditions, the radio refractive index of air, represented by the symbol "N" for "Normal," is slightly over 1 (more specifically, 1.000345 to 1.000300). Pressure decreases with height in a logarithmic manner at about 1 mb for every 10 m in altitude. Temperature decreases 20 degrees Fahrenheit for every mile of increasing altitude in the troposphere up to approximately 40,000 feet. Along with pressure and temperature dropping as altitude increases, water vapor content also drops. (This is what is meant by "normal weather conditions.") The air is very dry when you are up there in a jet, flying across the U.S.

Decreases in temperature and water vapor are what most affect extra long-range VHF/UHF and microwave DX. When the weatherman talks about a high pressure system settling in for a few days with an expected temperature inversion, get ready for the possibility of a major "bump" in the normally smooth refractive index. At about the thousand-foot level, the inversion causes the temperature to quickly increase instead of decrease, as would be normal; and water vapor content abruptly drops; the air gets dry as a bone inside this thin inversion layer.

An inversion layer strong enough to create a big DX tropo duct develops as part of a stationary high pressure system. The high pressure "cell" is characterized by air descending toward the surface of the earth. As the air begins to drop, it gets warm. They call this "subsidence." At about

Photo B. Paul Leib KH6HME inside the beacon shack ready to work long-haul VHF and UHF DX back to the mainland.

Photo C. The KH6HME QSL "card" to Chip Angle N6CA confirming the record-breaking 1296 MHz contact of 2472 miles. Photo courtesy of KH6HME.

Continued from page 14

the 1,000 foot level within the high pressure air "fallout," surface winds—especially those cool moist winds associated with large water masses—keep the descending air from bottoming out on the surface of the earth (ocean or land mass). This creates a band of warm dry air associated with the high, "capping," cool moist air below it. If the winds are gentle, this inversion layer may extend for hundreds or sometimes thousands of miles, and VHF and UHF waves are caught up in it. It acts like a waveguide; the radio waves go and keep going, with almost no attenuation.

Bruce Eggers WA9NEW, an expert in the study of super refractivity, says, "In the Northern Hemisphere, there are two very permanent high pressure systems which combine all the parameters contributing to super refractivity and tropospheric ducting...the Pacific high to the north and east of Hawaii, and the East Coast of the U.S. where the Gulf Stream brings warm water north along the coast. And in the Southern Hemisphere, there are some interesting potential tropospheric ducts, from the most southern islands in the Pacific (Pitcairn) to Chile and Peru. There is also the path between St. Paul and Perth, over the Indian Ocean."

Experts agree it is relatively warm dry air, associated with a high pressure system over cool, moist air, which can trigger extra long VHF and UHF/microwave ranges. These same conditions may also occur behind cold fronts, and in advance of warm fronts, where propagation will occur at higher frequencies like microwaves, rather than VHF frequencies. This is because the frontal zone is just the right thickness, neither too high nor too low.

The most consistent summertime and fall record-breaking tropospheric duct occurs between California and Hawaii. The discovery of this yearly phenomena was confirmed on July 8, 1957, when John Chambers W6NLZ in California successfully contacted Ralph Thomas KH6UK on 2 meters, repeating the 2,540 mile haul on the 220 MHz band from two years before. Then Louis WB6NMT made the grade on 70 cm in the early '70s. In 1983, Chip Angle N6CA and Paul Lieb KH6HME made a record-breaking contact on the 1296 MHz band. Paul and Chip have set their sights on the microwaves beyond 1296 MHz, and who knows when the California/Hawaii duct may support two-way communications as high as 10 GHz?

But nothing is more important than knowing when the band is open. Even the very best tropospheric duct will be an absolute loser if the gangs in Hawaii and the mainland don't realize the band is open.

The California–Hawaii Duct

In the United States, automatic beacons of 100 watts or less, operating on VHF/UHF and microwave bands, assist in the detection of a long-haul duct. It takes an SSB transceiver to pick up these beacons. The most distant beacons heard are on the 8,200-foot slopes of Hawaii's 13,680-foot Mauna Loa, an active volcano.

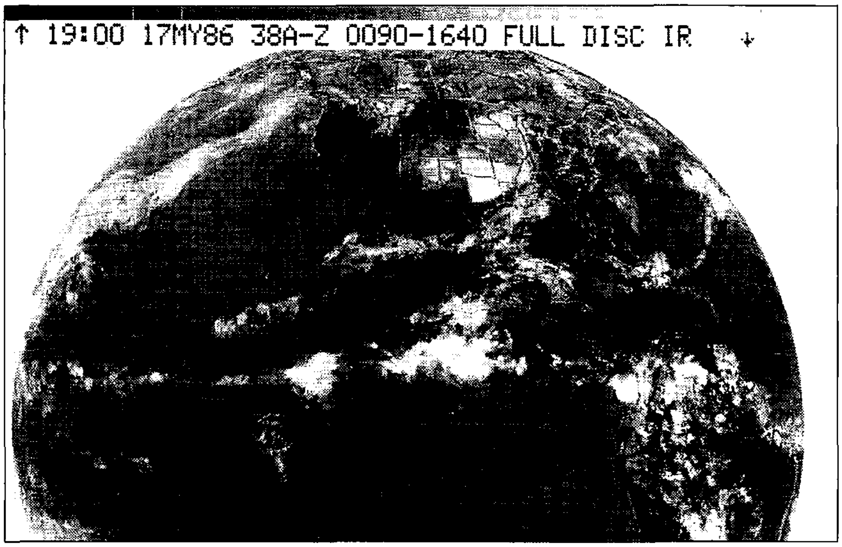


Photo D. A high pressure system sitting between California and Hawaii can be seen as a smooth haze on this satellite photo. A spectacular 1296 MHz opening occurred this day.

All beacons operate simultaneously in the CW mode, identifying KH6HME. The 2 meter beacon signals at 20 wpm, with a rise in the final steady tone by approximately 100 Hz. The 432 and 1296 MHz beacons operate at 13 wpm.

Hawaii ham Paul Lieb KH6HME is the main man at the beacon location. Hawaii television Channel 9 has allowed Paul and his beacons to occupy a metal building that's precariously perched on the side of the Mauna Loa volcano—a volcano that sees red hot lava activity just a few miles south of the beacon location!

Paul is alerted to the reception of the beacon signals by West Coast amateur radio operators. The beacons have been heard as far north as Oregon, and as far south as Mexico.

"When I get the phone call that the beacons are coming in, I pile all of my transceivers into the back of my station wagon, and take the one and a quarter hour drive from Hilo to the Mauna Loa beacon location. And as I go

KH6HME Beacon Characteristics

Beacon Location	19° 35'19" N; 155° 27'10" W
Elevation	8200 feet on the side of Mauna Loa volcano
6 meter beacon	50.061 MHz, 20 watts, 3-element beam, toward the mainland
2 meter beacon	144.170 MHz, 60 watts, into a pair of home-brew 7-element yagi (NBS) horizontal antennas
222 MHz band	No beacon, just two-way
70 cm beacon	432.075 MHz, 35 watts output, into a pair of long-boom horizontal yagis
ATV	434.000 MHz (on command, alternates with the CW beacon), 80 watts peak video output into a pair of K1FO beams.
900 MHz	two-way equipment
23 cm beacon	1296.000 MHz, into a stack of 4 loop yagis
Liaison frequency	28.885 MHz USB, 100 watts into full wave loop

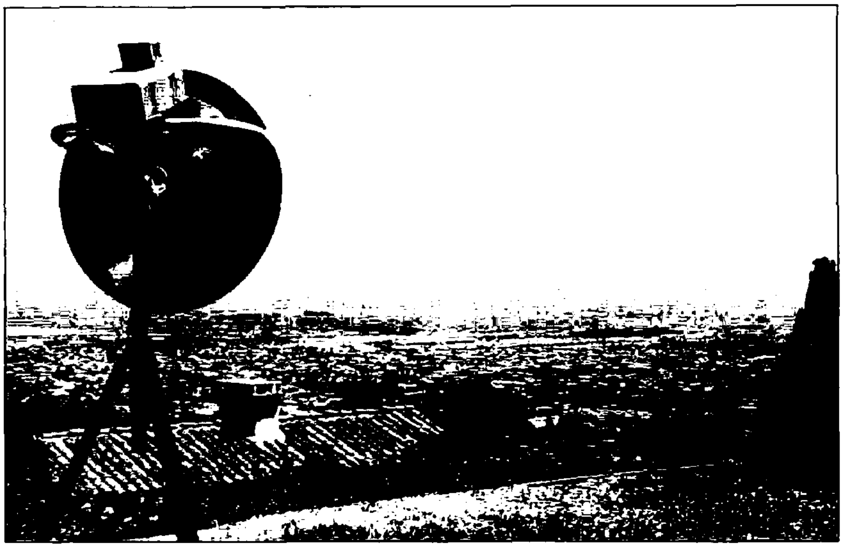


Photo E. *Will 10 GHz contacts be possible between California and Hawaii? (Author's setup at Palos Verdes, California, pointed towards Hawaii).*

up the mountain, passing through the different tropospheric levels, I can hear the mainland FM music broadcast stations get louder and louder," says Paul. He also gets the word out on the local repeater to Russ KH6FOO, Al KH6IAA, and Jack KH6CC, that tropo time has arrived. These operators give additional contacts to the mainland when the tropospheric duct gets low enough to their home locations.

"When I get to the site of the beacons, I can usually look out on fog and low clouds approximately 500 feet below our 8,200-foot elevation. The air is sometimes quite warm, and this tells me I'm right in the middle of the duct."

A New Challenge for ATVers

This year, Paul is trying a new mode of communications between Hawaii and California: amateur television at 434 MHz. Using PC Electronics' equipment, a Mirage 80 watt repeater amplifier custom-tuned by PC Electronics, and the Elktronics' video ID board, a new type of world record may soon be set for all ATVers to enjoy. FM signal strengths will need to peak well over S-9 in order for an ATV signal quality of P3 to be achieved, but in the past, 60 dB over S-9 narrowband FM signals have easily made the grade. According to Paul, "Sure, it can be done if the tropospheric layer achieves just the right thinness to trap the 434 MHz ATV signals."

If you are not equipped with an SSB transceiver, you can still make some long-range tropospheric duct contacts on FM. Between Texas and Florida, 25 watt FM rigs have sufficed. Just a few years ago, a widespread opening allowed mobiles in Boston to work mobile stations in Florida on 146.520 MHz FM! And most recently, FM hand-held contacts took place between Miami and Cuba—albeit both stations were using handhelds atop tall buildings. Nonetheless, the tropo duct allowed them to exceed FM handie-talkie range well beyond what could ever be expected under the best of conditions.

This summer, keep an eye on your television for signals from an outside antenna system showing up on normally unused channels. If you're on cable television, chances are the only way to detect a long-haul tropo duct is interference lines coming in over the master cable link receive station.

You can hear a tropospheric duct quite easily on your automobile or home FM stereo receiver. Once again, tune to frequencies not normally used in your area, and listen for distant stations. Same thing with your FM 2 meter and 432 transceivers—listen to repeaters coming in on frequencies that are normally absolutely vacant. Try programming repeaters over 200 miles away into your mobile, and wait for a hot, windless day to see whether or not you can pick them up.

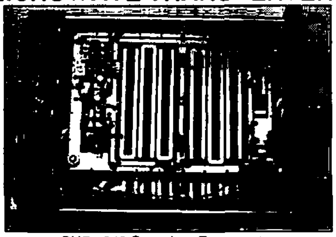
Every summer, long-haul tropospheric band openings occur to span distances well over 1,000 miles in the United States, and also between California and Hawaii. Sure, big directional antennas will give you the edge over smaller systems when the band opening is beginning to form, but once the tropo duct gets into full swing, almost any kind of VHF antenna should work the path well.

On FM, stay with vertical polarization. On sideband, most beacons and most DX stations operate horizontal. Cross-polarization within a duct could knock down signals by as much as 9 dB—so keep your antennas in the same plane.

Who knows what will happen with global warming, and with the warm ocean currents now beginning to form in areas that, normally, have been cool? This could be the best year ever for anyone with any type of VHF or UHF transceiver, including a handheld, to enjoy the excitement of long-haul DX tropospheric ducting.

You may contact Gordon West WB6NOA at 2414 College Dr., Costa Mesa CA 92626. Please include an SASE if you request information.

MICROWAVE TRANSVERTERS



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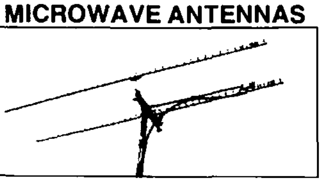
MICROWAVE ANTENNAS



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2355LYK	55el	Superlooper Kit	1296 MHz	22 dBi	$108.00
1345LYK	45el	loop Yagi Kit	2304 MHz	21 dBi	$ 79.00
945LYK	45el	loop Yagi Kit	3456 MHz	21 dBi	$ 79.00

Other models available Call or write for catalog

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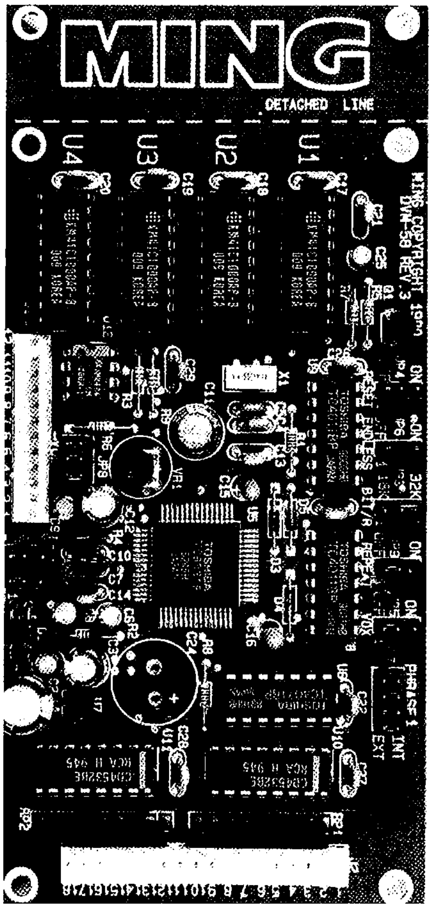

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CIRCLE 297 ON READER SERVICE CARD

Antennas by the Yard

HT antennas that really measure up!

by Ruston Cable WA6TLK

I wanted a rugged walkie-talkie antenna that would be tough, and also give me a little better performance than the standard rubber duck. This antenna is it. You can literally tie it in a knot without damage.

The required materials, shown in Photo A, are: an unpainted steel tape measure, binding post to male BNC or UHF adapter (Pomona P/N 3430 for BNC and P/N 1698 for UHF) and, not shown, some ½-inch PVC shrink tubing in the colors of your choice. *[Ed. note: If you can't find these adaptors at your local electronics store, they are available from Newark Electronics (312) 784-5100, P/N 35F1070 or 35F1069. Also Circuit Specialists (800) 528-1417, P/N 3430-0 or 3430-2.]*

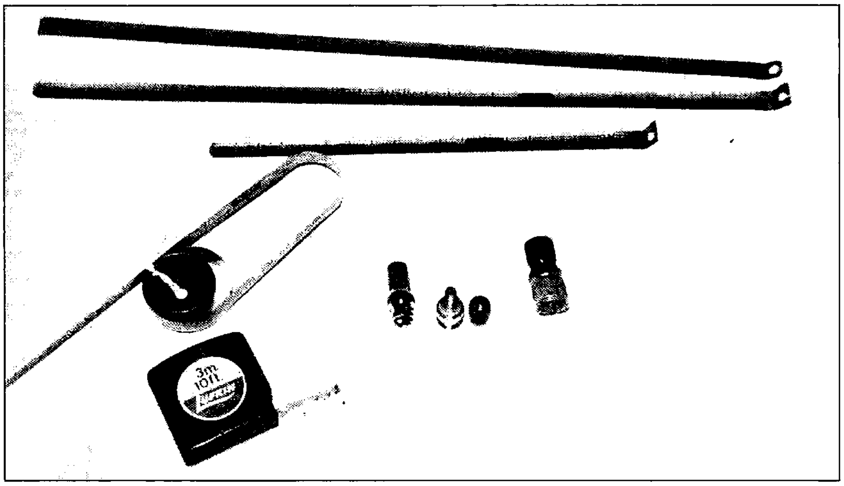


Photo A. Materials required.

Construction

If you haven't figured out what we are going to do yet, it's simple. Open up the housing of the tape measure, using whatever means is required. Inside you will find a nice roll of stainless steel antenna material, already marked off for you in inches, centimeters, feet, etc. Now, using whatever mathematical formula you like, calculate the length of tape needed for a quarter-wave length on the particular band for which you are making the antenna. Remember, these antennas can be made for any frequency: Civil Air Patrol, marine, MARS, scanner or aviation. I am using the amateur 2 meter band version for demonstration purposes. Construction for any other band is exactly the same.

Using a pair of scissors, I cut the length for the antenna to 21 inches. Remember to cut yours longer than calculated because it's a lot easier to cut the extra off than it is to add what you don't have. I then took a household ¼-inch paper punch and punched a hole near one end of the piece of tape (see Photo B). If you don't have an unpainted tape measure, now is the time to remove the paint from around the hole you just punched, using some fine, wet and dry sandpaper. This will insure a good electrical connection with the adapter. Also, trim off the corners on both ends of the tape using the scissors, then sand the ends to remove the sharp edges that are created from the cutting. Trust me, they are there and cut like a razor blade.

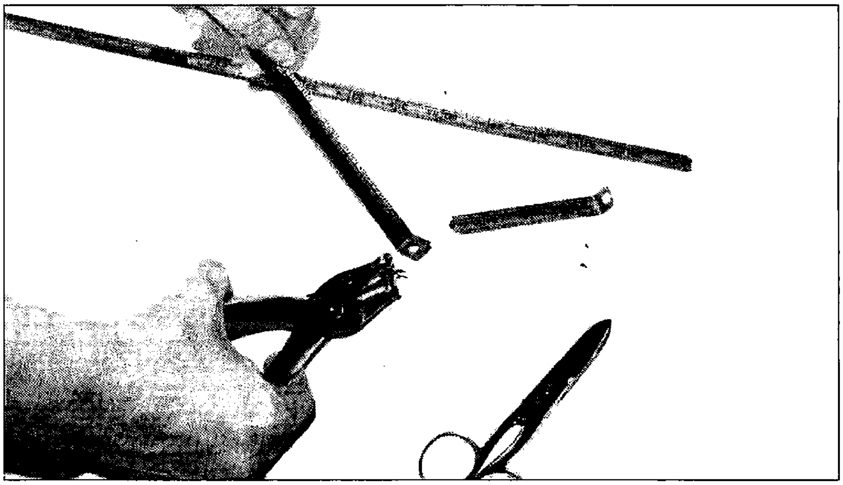


Photo B. Punch a ¼-inch hole near one end of the tape.

Now, the adapter. It doesn't matter if you're using the BNC or UHF adapter, the procedure is the same. First, remove the pretty-colored plastic-covered captive thumb nut. These thumb nuts are not intended to come off of the adapter under normal use, but they will if you use more then average force to unscrew them. If you have a really stuck one, use two pairs of small pliers and unscrew the thumb nut from the binding post.

You now have the two basic parts for the antenna. Run the binding post screw through the hole in the tape and screw the thumb nut back on as tightly as you can, using the pliers if necessary. Then, bend the steel tape flush up the side of the thumb nut. Put a piece of tape or rubber band around the antenna element and thumb nut to temporarily hold it in place. You now have an antenna ready to be trimmed to the desired frequency.

Tuning and Using the Antennas

To tune the antennas, I used a Bird Model--

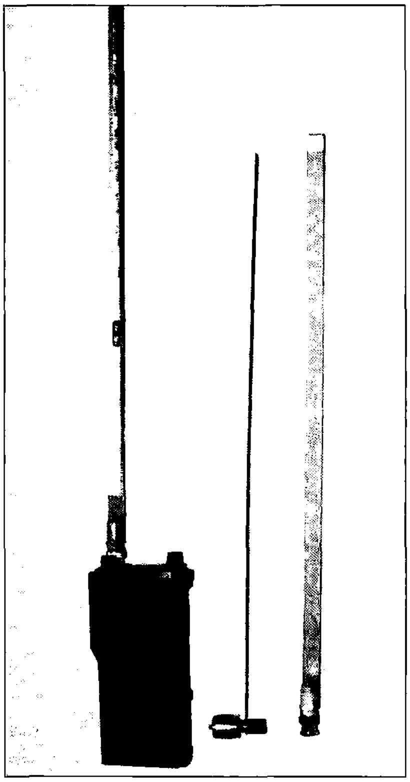


Photo C. The finished antennas.

43 thruline wattmeter and an ICOM 2 meter rig installed in the car. Use whatever setup you have to monitor the reflected power, VSWR or field strength. As shown in the picture, the actual trimming was done with my trusty scissors. The first reading on the Bird showed quite a bit of reflected power. And, knowing it was too long, I started cutting off ¼-inch pieces of tape from the top of the antenna until the reflected power started coming down toward zero. I then shaved off small pieces to get zero reflected power in the center of the band. The actual length turned out to be exactly 17 inches.

As a finishing touch, I offer two suggestions. Either cover the entire antenna with the PVC shrink tubing, or add just a small piece, about four inches, over the thumb nut area to hold the antenna element in the vertical position. The one with the small piece of PVC at the nut is a little more flexible, and lighter. It's your choice. It's best to use a heat gun to shrink the tubing over the antenna and connector. You can also use the hot burner of an electric stove as long as you keep in mind the PVC will melt and burn, so keep it from touching the hot element, but near enough to get good shrinking action. On the antenna that I covered completely with PVC, I added an extra piece of tubing over the thumb nut area to give it a little more rigidity and sturdiness in the base area.

That's it. After you make one, it takes about five minutes to make the next one. One option, if you want still more rigidity, is to put two or three antenna elements together and cover them all with the piece of PVC. I used three pieces of steel tape: one the length cut for least reflected power; the others one-third and one-half that length. This gives the antenna a tapered effect, with maximum flexibility toward the top of the antenna. No adverse effect was noted in the reflected power by the added layers of steel tape. The finished antennas are shown in Photo C.

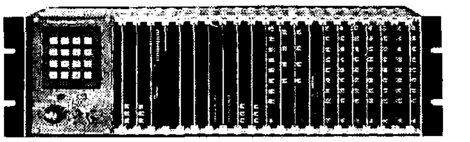
Originally, I used these antennas to replace the rubber duck antennas on walkie-talkies and other radios that search-and-rescue ground teams use. These radios are configured as back-pack radios, freeing the hands of the person carrying them. These antennas will take the abuse of going through the woods, and they will spring back. When they do give out, they are easily duplicated.

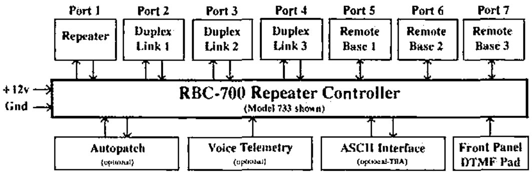
I have found one problem with the antenna completely covered with PVC. If it is rolled up to fit in your shirt pocket, or some other small storage area, it will not unroll quickly. However, this problem occurred at −10° F. Keep this in mind if you expect to be hamming in cool weather. 73

Contact Ruston C. Cable WA6TLK at 4623E. Pinehurst Dr. S., Austin TX 78747.

MULTIPLE REPEATER - LINK - REMOTE BASE CONTROLLER

Finally a controller that has solved control and audio interconnect problems between multiple radios. Your radio system can grow to multiple sites and stretch for hundreds of miles - and yet any radio can be fully controlled from any designated input.





The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

Several models are available and are software configurable to support up to 3 Repeaters, 5 Duplexed Links, and 4 Remote Bases. A group or club can start with the basics and expand their controller anytime by simply adding boards and software. Free software upgrades for one year after delivery. Finally, a real controller for the Linked system operator !

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CIRCLE 126 ON READER SERVICE CARD

73 Review

by Dick Goodman WA3USG

The VOR-2 Video Operated Relay

P.C. Electronics
2522 Paxson Ln.
Arcadia CA 91007-8537
Price Class: $45.
Tel. (818) 447–4565

Control your ATV repeater with this versatile circuit.

About eight years ago the members of the Keystone VHF Club in York, Pennsylvania, decided to build an in-band ATV repeater (439.25 MHz in, 426.25 MHz out). We decided to add a UHF FM receiver from Hamtronics for center carrier audio detection. Most importantly, the receiver would pick off the necessary AGC voltage to drive the COR (Carrier Operated Relay), which activated the repeater exciter upon receiving a signal.

Upon completion of our repeater, our worst problem was receiver desense. This manifested in two ways: interference on the transmitted video in the form of cross-hatching, and an inability of the center carrier FM receiver to properly drive the COR.

Using a spectrum analyzer and judicious tuning of the exciter and PA stages, John Shaffer W3SST eliminated all but a vestige of desense. However, we were never able to make the center carrier receiver drive the COR reliably. We had to come up with something else.

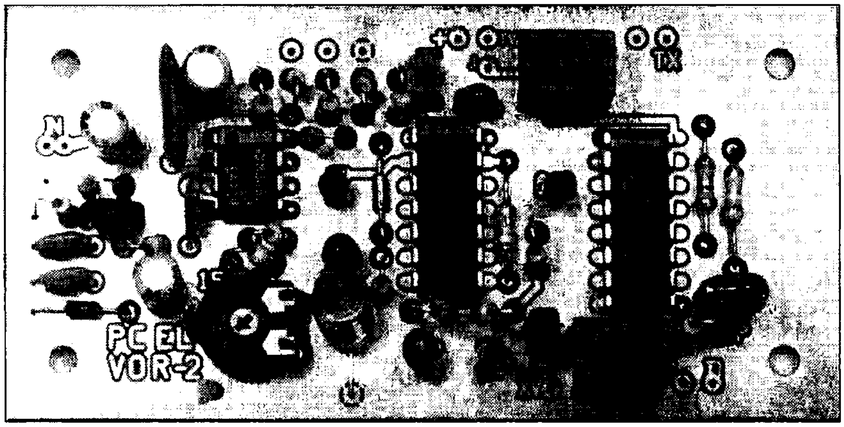

Photo. The P.C. Electronics VOR-2 Video Operated Relay.

The First VOR

When we began, there were no pre-packaged ATV repeater controllers. Builders of ATV repeaters had to use their ingenuity to obtain proper COR control, receiver "hang time," legal video ID, and the like. I decided to use my knowledge of TTL logic to design a complete ATV repeater controller.

Building the timers, relay drivers, and video switching circuits went quite well. I decided to get rid of the center carrier receiver COR and opt for a system driven by the detection of horizontal sync on the video carrier.

In theory, this would be much more immune to "falsing" and desense than the previous system. The heart of this system was a VOR (Video Operated Relay) board manufactured by PC Electronics in Arcadia, California. This circuit was designed around a NE567 PLL chip tuned to lock on 15.750 kHz. It was connected to the video output of the repeater receiver, and upon receipt of a bona fide ATV signal, would drive a relay and key the repeater exciter.

Initial tests were quite promising. When a strong ATV signal came on-line, the VOR worked perfectly. When the signals got weak (P2 or less), or the transmitting station did not have the correct sync to video ratio, the system would drop out. Since the video waveform is quite complex, the original VOR did not always "see" sync when the signal was weak (mixed with noise) or clipped (distorted/low in amplitude).

This first controller and the repeater functioned well under most conditions, however, and we lived with this system for several years.

The VOR-2

Recently, the club decided to build a cross-band ATV repeater (439.25 MHz in/923.25 MHz out). All components were purchased from P.C. Electronics in Arcadia, California. As I started to design a new controller, I noticed an interesting product offered by P.C. Electronics: the VOR-2 Video Operated Relay.

The VOR-2 senses horizontal sync, locks on it, and picks up a relay. It is also designed around the NE567 PLL. There are many substantial improvements and additions to the original VOR design, however. Baseband video from the receive system is connected to the input of the VOR-2. From here it is routed to a sync stripper where good clean horizontal sync is picked off and presented to the 567 PLL. THIS CIRCUIT WORKS WELL!

On our repeater it will key up very reliably on signals down to the level of P-0 (sync bars only!). The "lock on" frequency is adjustable, with an on-board trimpot. This should be set with a frequency counter connected to the appropriate test point with no video applied. The locking range is advertised as plus or minus 800 Hz.

Absolutely everyone who has tried can bring up our repeater, so I have no reason to doubt this. We have users running old monochrome line-frequency derived cameras, camcorders, computer generated graphics, and plain old lousy sync, and they all key the repeater equally well. There is also a built-in 10-second "hang time" to allow for repeater ID and to keep noisy or weak signals from dropping in and out. This delay is adjustable by changing the value of a resistor.

A Complete Repeater Controller

As well as providing excellent COR capabilities, the VOR-2 has virtually all the features of a complete ATV repeater controller. There are two relays on board the VOR-2. One keys the transmitter under control of the NE567 PLL, the other automatically switches the received video to the input of the transmitter when a valid video signal is present. This second relay also switches the exciter video input to an alternate video source during the 10-second hang time when no video carrier is present.

A video source such as a camera aimed at the repeater's callsign, computer graphics with the repeater's ID, or a video character generator/ID board such as the Elktronics VDG-1, will provide excellent and completely automatic video ID. If a video carrier is present

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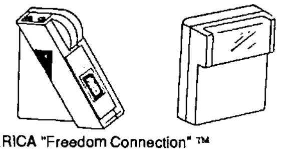

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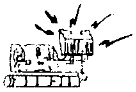

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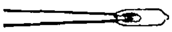

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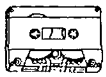

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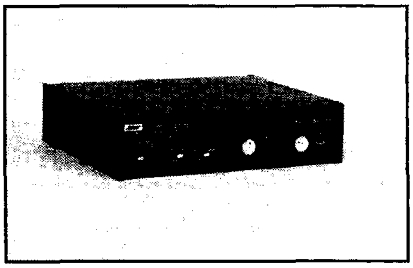

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for more than nine minutes on the repeater input, the VOR-2 will automatically switch to the second video source for about five seconds to meet the FCC's ID requirement. Both of these periods may be changed by changing the appropriate resistors on the VOR-2.

We have the VOR-2 and an Elktronics VDG-1 Video ID board packaged together in a Bud RF-proof mini-box in our repeater. Together they function as a complete ATV repeater controller in an area of about 7" x 4" x 2". We had only one problem with the VOR-2. Because the NE567 PLL COR is extremely sensitive, we had some very slight receive desense that caused the VOR-2 to lock on itself. This was cured by installing the VOR-2 in an RF-tight box, using feed-through capacitors on all inputs and outputs and an interdigital filter on the 439.25 MHz receive feedline, and keeping the receive and transmit antenna separation greater than 10 feet. This repeater has been in operation for over a year now with no other problems.

Other Uses

The VOR-2 can be used for applications other than repeater control. It may be used to activate a VCR whose input is set to the repeater output frequency (through a downconverter). The relays on the VOR-2 may be interfaced to the VCR to operate the record function when video is present. An interface could also be built to apply or remove AC power from the VCR if desired.

An inexpensive Sonalert may be purchased and energized when video from the repeater is present, which would be an excellent way to monitor activity when you're away from the shack. This would also be a good way to monitor security at your club site. In your shack, the VOR-2 could be used to energize your ATV equipment when video is detected from any video source. Finally, the VOR-2 could relieve you of remembering to video ID your station at the appropriate 10 minute intervals.

The documentation supplied with the VOR-2 consists of a single data sheet. Full schematics are included, as are suggested operating configurations. This is more than adequate, considering the ease of hooking up this circuit. Don't let the VOR-2's simplicity fool you, however. The VOR-2 coupled with some form of video ID generator fulfills all the requirements of a capable ATV repeater controller. 73

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The Megaloop

Perfect for megalomaniacs.

by Stan Gibilisco W1GV

Have you ever wondered what would happen if you connected your HF transceiver via a transmatch to an infinitely longwire? Or to a wire 100 miles long? Or to a loop running all the way around the state line of, say, Kansas?

Most hams have heard old-timers tell stories of finding an unused telephone line a few miles long and using it as an antenna to work the world on a few watts.

A couple of years ago, following a serious accident, I returned to my parents' home to recuperate. I got on the air with the help of some old ham friends who donated time, muscle, and equipment. During that winter, I put up a longwire measuring 880 feet, and got great results. It was a good performer on all bands 80 through 10 meters, and wasn't bad on 160, either. Mel Larson KCØP had advised me to put up a longwire if there was any opportunity; he said I wouldn't regret it, and I didn't.

Nor do I regret my most recent experiment, a huge horizontal loop of wire that I call the megaloop.

A Far Out Concept

An infinitely longwire or loop, if either were possible, would have certain characteristics. First and most significant is that a change in frequency would make no difference whatsoever in the performance of the antenna in free space. It would have an infinite number of current loops, no matter what the wavelength of the signal applied to it. The impedance would be purely resistive; there would be no standing waves because no power could be reflected from the end of an endless antenna.

I've done some experiments that suggest that an antenna of about 50 wavelengths or more may be considered, in practice, infinitely long. As the electromagnetic field propagates from the feedpoint of such a longwire, the current and voltage loops diminish in magnitude the farther one gets from the station. See Figure 1(a). This is because the field radiates as it travels, and this radiation, along with ohmic loss in the wire itself, dissipates the signal. Even with a perfectly conductive wire, this effect would take place, solely because of the radiation resistance of free space. By the time the field has gone about 50 wavelengths, most of it is gone forever into the vacuum of space. If the longwire were a loop measuring, say, 100 wavelengths in circumference, you'd observe a similar effect. See Figure 1(b).

The vacant field to the north of my parents' house measured about 700' x 1200', the long way being east-west. In 1987-88, I ran the 880-foot longwire from the house to the west-northwest; in 1989, I ran a loop around as much of the field as I could manage. I don't know exactly what the circumference was, but it was probably about 3800 feet, or 0.7 miles.

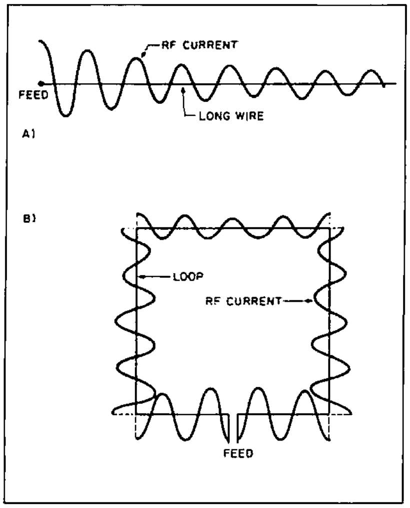


Figure 1. Current intensity diminishes as the electromagnetic field travels away from the feedpoint. (a) An antenna 50 wavelenghts long may, in practical terms, be considered infinite.... (b) A 100-wavelength loop with similar characteristics.

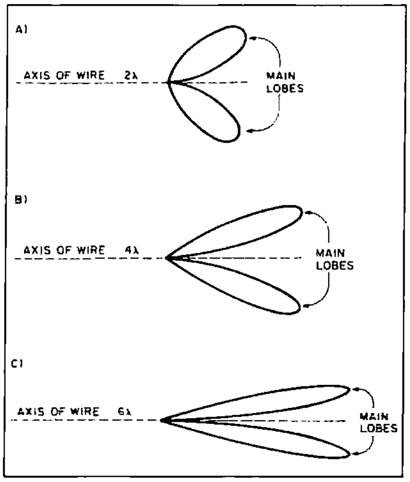


Figure 2. Main lobes for terminated longwires at different wavelengths.

Directional Effect

This is the second most important characteristic of an arbitrarily longwire. A large, strong lobe develops when a wire becomes more than a few wavelengths long. There is a limit to how much gain can be realized from this lobe. See Figure 2. This is because of the effect of radiation loss mentioned above; but certain long-wire configurations, like the terminated rhombic, can have around 30 dB of power gain relative to a half-wave dipole.

Minor lobes, now shown in Figure 2, also appear, and they become more numerous as the wire is made longer. An infinitely longwire would theoretically have infinitely many minor lobes. A wire 50 wavelengths long would have so many minor lobes that we might think of them as a single field; they would tend to blend together because of wire sag and ground effects from nearby objects.

Bending the wire into a loop might be expected to eliminate the directional effects and cause the minor lobes to more completely blend. The result would be a fairly uniform radiation pattern as long as the loop was small enough to allow some of the electromagnetic field to travel all the way around. A loop of infinite circumference, or many miles, would behave essentially as a straight longwire fed somewhere along its length and running off forever in opposite directions.

My loop was about 100 wavelengths at 10 meters, 50 wavelengths at 20 meters, and 25 wavelengths at 40 meters. Especially towards the top of the HF spectrum, the megaloop is like an infinitely long, straight wire. But at 80 and 160 meters, it is not so overwhelmingly large, and can be expected to have nearly omnidirectional characteristics. The polarization would be horizontal on all bands. The antenna height above ground would ideally be at least a quarter wavelength, or 33 feet at 7 MHz, 66 feet at 3.5 MHz, and 130 feet at 1.8 MHz. I was able to get most of the antenna up about 50 feet, the height of trees around the field. I got wires over the trees using kites of the inexpensive, dime-store variety (bat kites).

And the Third Characteristic...

Diversity! The antenna covers such a large area that if fading is taking place in one spot, reception may be good at another spot. This diversity effect is observed with all longwires or rhombics, and it works for the phasing type of fading, where different components of an incoming field arrive in phase some of the time, and out of phase some of the time.

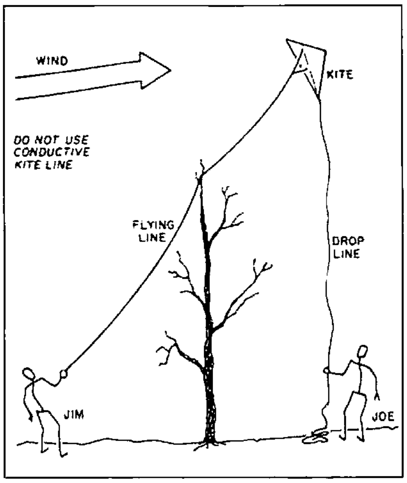


Figure 3. The kite technique works best with two people, so one can guide the flying line, and the other, the drop line. Only nonconductive line should be used for this operation.

Fading that occurs because of ionospheric absorption or a change in the maximum usable frequency (MUF) won't be reduced by diversity techniques. It's reasonable to expect that the diversity of the antenna would operate in transmit as well as in receive mode so that other stations would note less fading with the megaloop than with a small antenna such as a quarter-wave vertical, under conditions when multipath fading occurs.

The vacant field was scheduled for development, so the time was limited. I had to try out my idea of the megaloop during the winter of 1989–90, or never. This, plus the desire to grandly command the helm of such a device, motivated me to do it. Also, I hadn't heard much about anyone else having done it, though surely it has been tried before.

Materials

I used aluminum fence wire, Baygard®6 for the radiator. This six-strand wire, reinforced with nylon, is light and strong. It comes in rolls of a quarter-mile each. I bought three of these and used just about all of the wire for the megaloop.

With some nylon twine and a few old bat kites, I snagged the wires up in the trees, even though the wire is bare. In Minnesota, trees are fairly good insulators if it is below freezing. A good breeze, about 15 mph, facilitated the kite technique. See Figure 3. Also indispensable were warm mittens, as the temperature hovered around zero.

Feeding and Grounding

The megaloop can be fed in two ways. The preferable method is to bring the ends of the loop together into a parallel-wire line. See Figure 4(a). Then, to connect this line to the output of a transmatch equipped to deal with this kind of line.

If your transmatch does not have a two-wire line output, you may connect one end of the loop to the center conductor pin of the coaxial output, and the other end to chassis ground. See Figure 4(b).

Or you may leave one end of the loop free and connect the other to the center conductor pin or single-wire terminal. See Figure 4(c).

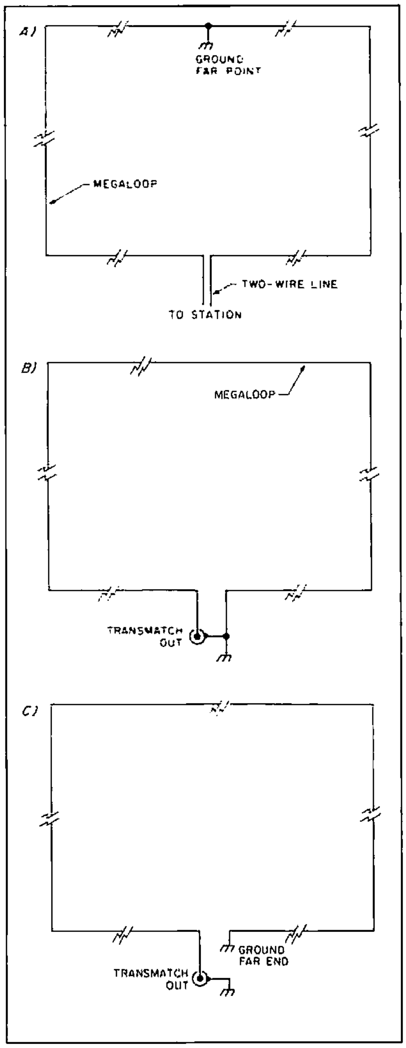


Figure 4. (a) Two-wire line is the preferred way to feed the antenna. (b) You can also feed the antenna with a transmatch having only single-wire or coaxial output. (c) An alternative method of coaxial feed.

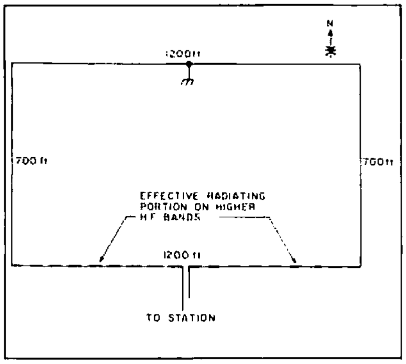


Figure 5. On the higher HF bands, only the southernmost leg of the loop at W1GV was really contributing to the radiation and reception in the megaloop antenna system. Nonetheless, the same basic advantages were realized.

In this case, the megaloop becomes a long wire bent into a circle.

I would recommend methods 4(a) or 4(b), but whichever method you use, a transmatch is necessary.

If the feed method at 4(b) is used, the loop is grounded for direct current, and this is good. Such a large antenna will develop electrostatic voltages because of atmospheric effects. It will actually be a hazard in or near thunder showers unless it is grounded for direct current. *Always, always disconnect the antenna from the rig when you are not on the air, winter or summer, storms or no storms. And never operate during thunder showers or lightning.*

With method 4(a), the loop should be grounded for direct current at a point opposite the station, or as nearly opposite as you can get. An eight-foot ground rod, driven into the earth well away from tree roots (copper can kill trees), and some buried radials, will ensure that you don't get clobbered when you touch the antenna wire. Some transmatches "ground" the antenna via the output of a two-wire feed balun. Do not rely on your transmatch for grounding, however, since some do not have this feature.

Putting It to the Test

Whatever theory may tell us, the way to decide how well an antenna works is to use it. Just because it will produce contacts does not mean that an antenna is a good radiator. I have worked stations over 1000 miles away by loading up a pair of ground rods spaced a quarter-wavelength on 20 meters. And you can work DX on a lightbulb.

Since I knew that a quarter-wave vertical with several radials is not a bad antenna, I compared the megaloop with a balloon-supported vertical on 40, 80, and 160 meters. A length of tubing was sufficient for a quarter-wave vertical on 20, 15, and 10 meters. (My radio doesn't cover the new WARC bands.)

The quarter-wave out-transmitted the megaloop on 160, and was comparable with the megaloop on 80 meters. Of course, that's no surprise. The megaloop did work better for close-in stations on 80; that may be attributed to the better high-angle radiation from the megaloop on this band.

As for reception, the megaloop was superior to the balloon vertical on 160 meters. The vertical was just too noisy. There was little difference on 80 meters, although some close-in stations were louder on the megaloop than on the vertical. The megaloop at W1GV was center-fed and grounded (marginally, because the earth was frozen) at the far side. This might be expected to reduce noise somewhat, along with the horizontal polarization and the comparatively low placement of the antenna (only 50 feet above the ground).

On 40 meters and above, verticals and the megaloop were just about equal for transmitted and received signal strength. This would be the expected result; both antennas are omnidirectional (essentially) and neither has any appreciable gain, except maybe on 10 and 15 meters. The feedpoint at W1GV was roughly in the middle of a long east-west run of wire,

Continued on page 44

Lightning Protection

Want some peace of mind?

by Frank A. Finger NU1A

We've all heard gruesome tales of damage caused by lightning. Many articles have been written about how to protect your valuable electronic equipment. All of the suggestions are valid, and if followed, will give some measure of protection. In this article, I'll cover some new methods as well as some of the accepted schemes. Anything to protect that expensive equipment is worth trying!

Believe It or Not

While reexamining one of my old physics books, I came across a formula for the discharge from a sphere. My attention was attracted to the following sentences. "It has been previously shown that the maximum charge that can be retained by a conductor in air is limited by the fact that the air itself becomes conducting at an electric intensity of about 3 x 10^6 volts per meter. $V_m = a \bullet E_m$. E_m is the maximum voltage; a, the radius of the sphere. For a sphere one centimeter in radius, E_m = 30,000 volts, and no amount of 'charging' can raise the potential of a sphere this size, in air, higher than 30,000 volts."

The implications of this are almost unbelievable.

Since the maximum potential at the sphere is directly proportional to the radius, suppose we make the radius very small? A pointed wire or rod is a sphere of very small radius. Now this pointed wire will discharge into air at a potential of a few hundred volts! This means that the area around the tip of the wire can not exceed a few hundred volts, and it will be impossible for a voltage buildup of the extremely high potential needed for a lightning strike. Boy, can we use something like that!

Automobile antennas used on cars in the early '30s were just a piece of hard wire mounted on an insulator. The wire would wipe electrons from the air, and as charges built up they would discharge into the air. The result was static. Using the above theory, an engineer came up with the idea of putting a small ball on the top. This increased the discharge potential so that discharges were no longer causing noise and we had quiet reception at last. Those little balls on the ends of our auto antennas are not just for decoration.

The Genesis of Lightning

As a thundercloud builds up, strong air currents form inside it, updrafts being the strongest. As particles of air pass particles of moisture, electrons are dislodged. In a short time, this creates large areas of negative charge and positive charge. Eventually, the voltage reaches the breakdown point, and lightning discharges the areas.

As the cloud moves across the sky, a charge of equal but opposite value follows along on the ground under the cloud, much like the shadow a low-flying airplane would make. When the charge builds to several million volts, we eventually have a lightning bolt, which discharges the area. Then it begins all over again.

As the ground charge passes under your tower, it charges up your tower and reduces the distance from the ground to the cloud by several tens of feet. If the charge reaches a critical value, we have lightning hitting your tower. The challenge is how to prevent this high charge buildup.

The Pointed Rod

Using the theory noted above, let's mount a very sharply pointed rod on a pipe extending above your beam or tower. Theory says the potential at the sharp point can not exceed a few hundred volts. This will NOT allow the charge to build up to the millions of volts needed for discharge. The result: no lightning strike! Why do you think they make lightning rods pointed? You guessed it—someone already thought of this, but failed to apply it to amateur radio! I am re-inventing the wheel, so to speak.

I live on a hill above a lake. I have two towers, the tallest being 60 feet. The beam support pipe sticks up another eight feet, and mounted to this is my sharply pointed rod. In 20 years I have never had a lightning hit, although trees around the neighborhood and some TV antenna towers have been hit.

The United States power squadrons say that you have a cone of protection spreading out from the point at about a 30 degree angle. Nice protection for the home and the trees in the yard.

Yes, theory really works.

Using Inductance

Often lightning strikes nearby, inducing large pulses of energy into nearby telephone and power lines. The large pulses find their way into our homes via the wires. Transistorized and integrated circuits are especially vulnerable. What can we do?

Again, let's go to theory. Remember the coil? It offers AC resistance called inductance. The lightning-induced pulses are half cycles of alternating voltage at very high frequencies, so a coil in the attachment cords should work quite well. Let's tie several plain knots in the cords and we have quite effective protection. Sounds silly, looks ugly as sin, but it works great.

I have seen receptacles blown out of the wall, and the equipment with knots in the cords undamaged. It works. Easy coils, I call them. The coiled cords on telephone handsets are good protection to a person talking on the phone during a thunderstorm. Lots of inductance there.

Those of us with computers and modems to the telephone line can protect our modems with knots in the cord, though it would be neater, and probably more effective, to wrap the cord a number of turns on a ferrite core.

At the base of your tower, it's a good idea to install a gas discharge tube in the coax line. Next, you can use inductance again by making a small coil of several turns in your coax cable, taping them in place with electrician's tape. It doesn't affect your RF energy. The coils impede the lightning pulse, and the gas discharge tube passes it to ground.

Of course, a good ground system will help immensely. Run a good ground wire from your tower to a good ground rod, then around your house to the telephone or power company ground rod. This wire buried under a few inches of earth will give a good ground. If you have several towers, adding a good ground wire to connect them all provides additional protection. I once asked an engineer how large a wire to use. He said, "The fatter the better." But I think a #6 or #8 guage wire gives reasonably good protection for the money.

A G.E. engineer discussing similar protection for their remote repeater sites on mountains said that measures like these probably provide about 90% protection. He said that someday the granddaddy of them all might come along and zap your installation, but the items suggested would be about as good as you can do.

Another suggestion was to run about two lengths of iron conduit up the tower leg and strap it tightly to the tower, then run the cables through the conduit. It will act as a one-turn short and prevent the pulses from propagating down the coax and into the house.

I never disconnect my radio equipment during storms, and I've never had any damage. It is nice to be able to so cheaply protect my equipment and home at such reasonable cost. A few knots, a pointed rod, a few feet of ground wire, and a couple pieces of pipe sure can give you peace of mind. 73

You may write Frank Finger at 9 Pressey Ct., New London, NH 03257. Please enclose an SASE if you wish a response.

The Flight of STS-37

The first "all-ham" crew.

by Philip Chien KC4YER

The flight of STS-37 was a shuttle mission that seemed to be designed specifically for the amateur radio community. All five astronauts had their ham licenses, and the ham activities would include slow-scan, packet, and voice operations, and the first attempt to receive live television aboard the shuttle, plus—with some luck—a direct contact with the Soviet space station *Mir*. The mission would also include the deployment of one of the heaviest scientific spacecraft launched and the first post-*Challenger* spacewalk.

The *Atlantis* launch had originally been planned for November 1990, but hydrogen leaks in the main propulsion system delayed the launch until April 1991. The delay actually helped in one way: Pilot Ken Cameron KB5AWP convinced his fellow crewmembers (Commander) Steve Nagel, (and mission specialists) Jay Apt, and Linda Godwin to get their ham tickets, but (mission specialist) Jerry Ross was the hold out. Jerry promised the rest of the crew that if the launch delayed beyond November he would get his ticket, and when the launch was delayed he kept his promise and got his technician's license. The crew was extremely enthusiastic about the SAREX experiment, and Steve Nagel quipped, while introducing the crew, "Other crews may claim to have a ham or two aboard, but this is the first 'all ham' crew."

Pre-Launch Tests

To check out the SAREX hardware on *Atlantis*, Lou McFadin W5DID, an Aerospace Engineer at the Johnson Space Center (JSC), came to the Kennedy Space Center (KSC) along with Jerry Coles KB5ARA of JSC, John Stahler WB6DCN of Robot Research, Andy Bachler N9AB of the Motorola ARC, Schaumberg, Illinois, and Kai Siwiak KE4PT of Motorola, Ft. Lauderdale. KSC ham Mike Peacock KC4UGT loaned us his transceiver and helped us as a third hand and escort (see Photo E). (*Atlantis*'s hangar, the Orbiter Processing Facility, is considered a hazardous facility because of the poisonous fuels and high pressure gasses, and whenever anybody's in the building they have to be escorted by a trained person like Mike.)

While plenty of tests had been performed in the JSC shuttle simulators, a set of SAREX tests was planned for KSC using *Atlantis*'s flight hardware. These tests would verify the actual SAREX flight hardware in the identical configuration which the astronauts would use during their mission.

Photo A. Liftoff of the Atlantis. *Photos A-F courtesy of NASA.*

Photo B. Pilot Ken Cameron KB5AWP makes a voice contact while in orbit.

Preparing the orbiter for flight is always an extremely hectic activity with many different tasks going on at the same time. We set up the prototype ROBOT box, a Sony Camcorder, a Panasonic VHS VCR/monitor, a 2 meter transceiver, and a Grid computer—basically non-flight versions of the SAREX hardware—plus a fast-scan TV transmitter on a test table close to *Atlantis*'s crew cabin. Since we were just a couple of feet away from the orbiter and it wasn't going to move anywhere, we didn't need a tracking antenna. Our fast-scan TV antenna was a helical antenna mounted on a broom handle stuck into a vise.

It took about 90 minutes to get everything configured in *Atlantis* and on the workbench.

Photo C. Mission Specialist Jay Apt N5QWL with SAREX equipment at the ready.

Photo D. Mission Specialist Linda Godwin N5RAX prepares to make a few ham contacts.

Photo E. (l to r): Kai Siwiak KE4PT, Andy Bachler N9AB, Lou McFadin W5DID, John Stahler WB6DCN and Jerry Coles KB5ARA perform pre-launch tests of the SAREX hardware as KSC technician Renee Wolf looks on. On the workbench (l-r) the PGSC (Payload General Support Computer)—a modified Grid laptop computer, the SAREX ROBOT box, and the Panasonic VCR/monitor.

Everything was ready, and the voice, packet, and slow-scan tests went fine. We QSOed the shuttle from the ground using handheld 2 meter transceivers. The voice quality was excellent—but of course we were right next to the shuttle and didn't have to compete with anybody else! Technically, though, we could say that we had QSOed *Atlantis*'s SAREX—even though it was just a couple of feet away! We weren't able to complete the fast-scan TV tests due to a faulty test transmitter. It was determined that the ATV receiver in the orbiter was functional, however. After a final verification, the SAREX hardware was packed in its flight locker and shipped to KSC on March 21st and installed in *Atlantis*'s crew cabin.

Photo F. Students from the Clear Creek school district (Houston, Texas) contact the Atlantis *from the Johnson Space Center visitor's center. (l to r): Gil Carman WA5NOM (seated at the tracking computer). Standing: Joey Kramer, Tracy Singleton, Kyle Beasley and Steven White. Standing to the far right is Chuck Biggs KC5RG (Chief of the Public Services Branch at NASA JSC).*

Photo G. Lyman High School (Longwood, Florida) students applaud their successful contact with astronaut Ken Cameron KB5AWP aboard Atlantis. Standing (l to r): Dick NØHOM, Russ WA3IBE, Fred N4NVW, Jennifer McCarrick, Mike KC4OHH, Jose Lopez, Gary Davies, and teacher Joe Laughlin KC4UBY. Seated (l to r): Ed WØRAO, John KC4IYO and Rick KC4ONA. Not shown is Joe Singer N4IPV. Photo by Phil Chien KC4YER.

Liftoff!

Atlantis's launch was planned for April 5, 1991, at 9:18 a.m. EST. Bad weather at the launch site, and range requirements, delayed the launch by 4 minutes and 45 seconds to 9:22:45 a.m. The ground shook and the skies roared as *Atlantis* took off on the 39th shuttle flight—just one week before the tenth anniversary of the first shuttle launch. Within three hours Ken opened up the middeck locker where the SAREX hardware was stowed and set up the rig next to his seat on *Atlantis*'s flight deck.

Atlantis was placed in a 28.5 degree inclined orbit to permit as much payload as possible, and was launched into a fairly high orbit (460 km or 243 nm.) to place the Gamma Ray Observatory as high as possible, permitting the longest possible lifetime. The high altitude increases the look angles for ground viewing stations, an extremely important issue for viewers at high latitudes. Since *Atlantis* was launched relatively early in the morning, most U.S. passes occurred during the daytime, much more convenient than STS-35's nighttime passes. However, with a planned five-day mission, STS-37 was the shortest SAREX flight to date.

As a secondary payload, SAREX only gets access to the orbiter's resources (including crew time) when it doesn't interfere with other operations. During the STS-35 Astro-1 mission last December, *Columbia* had to be pointed precisely to aim it at different objects in the sky. The continuous pointing resulted in relatively poor antenna angles. For STS-37, *Atlantis* was positioned for the best reception for many of the planned SAREX contacts.

School Contacts

NASA flies SAREX as part of its education program to help inform the public, especially students, about the space program. Consequently, the primary scheduled SAREX activities are pre-arranged contacts with schools. For STS-37, the schools were: Clear Creek independent school district, Houston, Texas; University School, Shaker Heights, Ohio; Discover Center Museum, Rockford, Illinois; Potter Jr. High School, Fallbrook, California; Hanover Elementary School, Bethlehem, Pennsylvania; several interconnected schools in southwest Oklahoma; Lyman High School, Longwood, Florida; Monroe Central School, Parker City, Indiana; Beaver Creek Elementary School, Dowington, Pennsylvania; and Reizenstein Middle School, Pittsburgh, Pennsylvania.

SAREX in the Future

NASA's current shuttle manifest does not show any official assignments for future SAREX flights, but there are several opportunities. AMSAT and the ARRL have asked NASA to fly SAREX on the STS-42 mission, currently scheduled for early 1992. On that mission the astronauts will operate the International Microgravity Laboratory (IML-1), a set of Spacelab microgravity experiments. IML will be launched into a high inclination orbit which will cover the Earth to 57.1 degrees north and south of the equator. The SAREX team is especially interested in flying high inclination missions to permit wider access to more hams around the world, especially U.S. hams in the central and northern latitudes. In addition, SAREX may fly on the STS-45 ATLAS-1 (ATmospheric Laboratory for Applied Sciences) mission in April 1992. It's likely that if schools continue expressing interests in participating in SAREX contacts, there will be more amateur operations aboard the shuttle in the future. The best way to let NASA know that there is interest in SAREX is to send letters to NASA's Education and Public Affairs departments at NASA Headquarters, Washington DC 20546. Letters to the ARRL and AMSAT are appreciated, but NASA needs to know that hams and teachers are interested in SAREX and the shuttle program.

If you're a teacher interested in participating in future SAREX missions, or know a teacher who may be interested, contact the ARRL at 225 Main St., Newington CT 06111. For the hams who cooperate with local schools, it's a rewarding activity and an excellent way to spend an afternoon (or evening or morning, depending on when it occurs). For the teacher it requires a fair amount of planning ahead of time, especially preparing the students and informing them about SAREX and the shuttle missions where you will be participating in. There can be frustrations—when the shuttle launch delays, when the encounters occur at inconvenient times (like during vacations or lunch time), when there isn't a high quality connection, etc. Everybody learns a lot even when things don't go perfectly, but when everything works—it's fantastic!

The Phone Bridge

To extend SAREX's capabilities to contact more schools outside of the flight path, the SAREX team uses a set of relay stations and phone bridges. The Figure shows how the phone bridge works for a typical school contact. The pre-arranged relay stations which communicate with the shuttle are located in Holtsville, California; Corpus Christi, Texas; and Ft. Myers, Florida. Other relay stations are located in Ecuador and Brazil for more southern orbits, and Australia for additional Australian school contacts. The relay stations use a phone network to conference call with SAREX control and a local ham contact close to the target school. The contact near the school patches the phone bridge into the local repeater, and the students talk on the repeater via a control operator located at the school. It's extremely complicated, and with five separate RF and hardwire segments there are occasional dropouts or weak connections.

Ask an Astronaut

The first STS-37 school contact was with students from Clear Creek independent school district who visited the Johnson Space Center and SAREX Control (see Photo F). As *Atlantis* came over his horizon, Ralph Warner N6MNN tried to contact the shuttle. It took several tries and about four minutes to get a good connection with Ken aboard *Atlantis*. The strength of the signal for this pass was fairly low, and the ground stations had to repeat the questions so Ken could understand them. As the orbiter went across the country, Bob Douglas W5GEL in Corpus Christi, Texas, and Don Carlson W4RDI in Ft. Myers, Florida, took over. All together, Ken and Commander Steve Nagel answered ten questions about their mission and training during *Atlantis*'s 19-minute pass.

I visited Lyman High School in Longwood, Florida, on flight day two to watch their attempt to talk to *Atlantis*'s crew (see Photo G). Joe Laughlin KC4UBY teaches a popular "Space, Technology, and Engineering" class and went all out for the SAREX contact. An essay contest determined which students would get to ask the astronauts questions. He took the lucky students to the Kennedy Space Center to see *Atlantis*'s launch on Friday.

The Lake Monroe Amateur Radio Society had set up their gear in Lyman's auditorium. John Rothert KC4IYO at the school contacted Joe Singer N4IPV at his home via the local repeater. Joe was connected via the phone patch with SAREX control and the relay stations.

For this pass, the California, Texas and Florida relay stations were used to relay questions from Potter Jr. High School and Monroe Central School, too. By the time SAREX control got to Lyman High School there was barely time for student José Lopez to ask Ken his question. Unfortunately, by the time Ken understood the question and started answering, *Atlantis* had passed over the Atlantic Ocean and out of range of the Ft. Myers relay station.

The next school contacts, an orbit later, went better. Ken talked with students at the Pennsylvania schools, and once again the last school didn't get a chance to get their question answered. Since the shuttle's orbit precesses to the west, the relay stations for that pass were Ted Jaramillo HC5K in Ecuador and Junior Torres DeCastro PY2BJO in São Paulo, Brazil. Ecuador wasn't able to connect to Ken successfully, but Junior was able to connect with Ken and patch in the students via the phone bridge.

We heard the good news just after that pass was completed. Since it had gone well, and the astronauts were willing, a backup pass would be used for Lyman High School and Reizenstein Middle School because we didn't get our questions answered! We immediately called the students who had gone home and told them to come back—they were going to get another chance!

As with the first time, Joe Singer called the phone bridge and we talked to him via the Lake Monroe repeater. We were hooked up with the relay stations over the phone bridge as the shuttle came over the horizon at Ecuador and everything was set. Then disaster struck—the repeater went down! Fortunately, the repeater came back up just in time

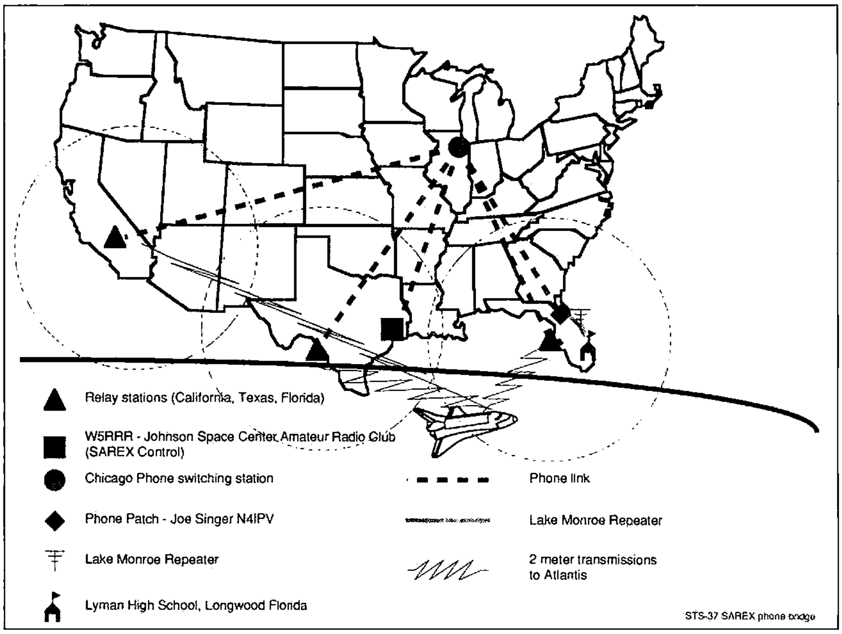
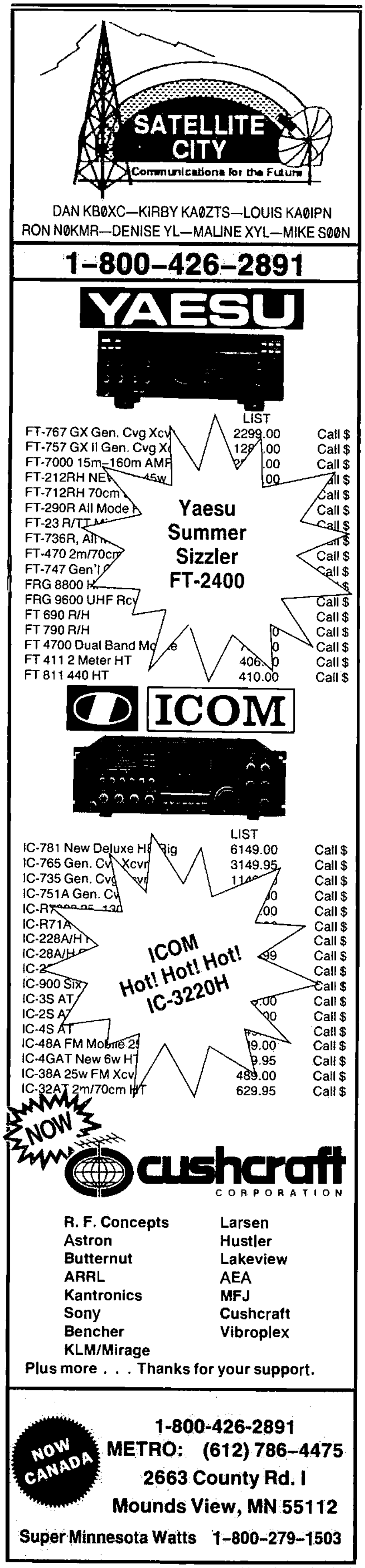


Figure. The intricate telephone bridge network made extended school contacts with the Atlantis a possibility thanks to relay stations located around the world. Figure by the author.



CIRCLE 153 ON READER SERVICE CARD

SAREX Comments From the Crew of STS-37 (from the Post-Landing Crew Press Conference)

Ken Cameron explained to us about the STS-37 attempts to contact *Mir*: "We had a couple of tries at contacting *Mir*. The ground had sent up messages letting us know when we had close passes, or what we call conjunctions. The closest was about 190 km. We called them repeatedly. There were arrangements for them to listen on a certain frequency. Unfortunately, there was still a lot of interference, probably due to other folks using their radios for other reasons on that frequency. We called them and we heard them calling us back. So, depending on your definition of real contact, I felt we contacted them. Certainly there were two small spacecraft up there orbiting the Earth, which were calling out for each other. That in itself is fairly significant—even if we didn't exchange words of great diplomatic importance. We were both up there, little points of light, and we tried to reach each other and share the view and share our thoughts. I really couldn't get an RST in the conventional sense—it was almost a one or a zero the way the radio was working. I heard Musa speaking English. I also heard over that area of the South Pacific what I thought at first was Russian, but I think it was just some other language that someone was transmitting in the area. I really couldn't tell. I tried Russian myself on Musa, but it probably didn't sound so red hot if they heard it. But I did my best after some college Russian classes. But Musa was speaking English."

Jerry Ross added: "We also did see *Mir* go across the sky just as the ground called up to us to look at the Big Dipper, and we poked our heads in all different windows and I was the first to spot it. Everybody else got a chance to see it, also."

Jay Apt said: "For all of us, it was a pretty profound experience to look up there and see the only other folks orbiting the planet, pretty close. I guess we were about 60 miles apart at the time. Just knowing that each spacecraft carrying its own world of oxygen and food was orbiting nearby and thinking to ourselves that that was pretty neat. And, there's probably never again going to be a time when men and women aren't continuously in orbit above our planet."

We asked Ken's crewmates how they felt about SAREX, and whether they would like to fly with it again.

Steve Nagel said: "Well, Ken was the 'primary ham,' as I called him. But I sure enjoyed the contacts I established. I had one where we talked to the students at Clear Lake here and I found that extremely enjoyable. I enjoyed having it on board. And Ken actually did manage the cables very well."

Linda Godwin said: "I think that all of us wish we had another day up there just to do more SAREX so we could have more time on the radio. I had one pass across Australia where I made some contacts, and one in New Zealand. It's kind of amazing that you're talking to the people down on the ground and you have a direct link with the folks down there you're seeing out through the windows. It's great."

Jerry Ross said, with a chuckle: "This was my first and ONLY two-way link on ham radio. So I have a very unique situation in the ham world."

Jay Apt said: "I felt privileged to be able to have direct contact with folks we were flying over. Jerry and I were talking one night about how neat it was to look down and think of all the cultures who were spread out below you and what those people were like, and I thought it was pretty neat to just have a way to talk to those people and learn about their cultures. I did talk to some folks in Australia and some folks in Hawaii, in addition to some of the school contacts we made. I think it's good for us to maintain some awareness that there's people on the ground different from you."

as Junior was about to complete his contact with the shuttle. SAREX control told us to ask our question and José and Jennifer McCarrick asked Ken questions about the Gamma Ray Observatory and how the body changes in space.

On the next day, when the astronauts woke up, they had several messages in their morning mail waiting for them in their TAGS (Text And Graphics System)—NASA's fancy term for a FAX machine. The SAREX sheet included "Thanks for going for the backup bridge on rev. 21. The kids at Reizenstein and Lyman were thrilled." That was an understatement!

All ten groups of U.S. schools were able to get through successfully during *Atlantis*'s flight. Unfortunately, everything didn't work as well as the school contacts. Several gremlins crawled into the system and the packet and slow-scan modes didn't work as well as predicted.

Packet and Slow-Scan TV

The packet and slow-scan television hardware is contained in the ROBOT box. The same box had flown with Tony England W0ORE on the Spacelab 2 mission in 1985 and was upgraded to add packet capabilities. Unfortunately, something happened between the last time the box was checked out on the ground and when the astronauts set it up in orbit, and the box would not work in its packet or slow-scan receive mode. Ground stations could hear the packet beacon and receive slow-scan pictures from the shuttle, but the astronauts couldn't receive slow-scan from the ground. The SAREX engineers thought that the problem was probably caused by a loose or broken cable and were anxious to get the hardware back so they could determine where the problem was and prevent it from happening again. *[Ed. Note: A broken*

wire in one of the cables was indeed the culprit!]

The astronauts still had the capability to transmit slow-scan pictures and sent many images of the crew cabin as well as the EVA activities. In addition, they made the best of the situation by spending more of their time in voice mode than originally planned.

Shuttle-*Mir* Contact

The Soviet *Mir* spacecraft was in an orbit which repeated around the earth at a similar rate to *Atlantis*'s orbit. While the two spacecraft were in widely separated orbits, they did pass close to each other on many occasions. The biggest problem preventing a ship-to-ship contact was crew schedules—both crews have to be available at the same time. During the STS-35 mission, *Columbia*'s crew tried to contact *Mir*, but the visiting *Mir* crew had just completed a docking and were shutting down systems on the ferry *Soyuz* spacecraft.

The most important technical problem is not the obvious one, the Doppler shift, but the relative velocities between the spacecraft. Since the spacecraft are in different orbits, they could be several thousand kilometers apart at one point, and a minute later be within a couple of kilometers of each other, and then thousands of kilometers apart in another minute. Besides limiting contacts to relatively short conversations, the antenna's pointing angles can be critical as the spacecrafts move relative to each other.

The most obvious problem for communications, language, was actually a non-problem. Musa Manarov U2MIR speaks English quite well and is extremely popular with hams around the world. On the U.S. side, while he hadn't used it in a while, Ken Cameron had studied a couple of years of Russian in college.

On the first flight day, Ken tried unsuccessfully to QSO *Mir*. The crew tried many times and did, at one point, hear the *Mir* cosmonauts. Musa (operating U2MIR) later confirmed hearing the *Atlantis* as well. This contact was the very first time that astronauts aboard a U.S. spacecraft had contacted cosmonauts aboard a Soviet spacecraft directly. (During Apollo-Soyuz, all radio communications between the spacecrafts were via their own ground stations.) Curiously enough, one of the first confirmations that Musa had heard *Atlantis* came from Ron Parise WA4SIR (who operated SAREX onboard the previous STS-35 mission), after talking to *Mir* from the Soviet mission control center he was visiting at the time!

Live Video Uplink

STS-37 was also the first attempt to receive live television aboard a U.S. spacecraft. Since *Apollo 7* in 1968, U.S. astronauts have sent back thousands of hours of inflight video, but have never seen broadcasts from the ground. The only monitors aboard the shuttle are closed circuit displays to monitor the shuttle's systems and on-board video cameras. During the *Spacelab 2* STS-51F flight, the astronauts got to see still frames for first time—via SAREX's slow-scan receiver. Until STS-37, no live television (fast-scan) had ever been received aboard a U.S. spacecraft.

Andy Bachler N9AB, a member of the Motorola Amateur Radio Club in Schaumburg, Illinois, developed the SAREX side-window-mounted antenna, and the fast-scan video hardware. Besides Andy's station, the other video uplink sites were Kai Siwiak KE4PT in Motorola, Ft. Lauderdale; Jim Steffen KC6A in Long Beach, California; and the Amateur Radio Clubs located at NASA's Goddard Spaceflight Center WA3NAN in Greenbelt, Maryland (using the U.S. Naval Academy's 40' dish in Annapolis), the Johnson Space Center W5RRR in Houston, Texas, and the Marshall Spaceflight Center WA4NZD in Huntsville, Alabama. The videos prepared for uplink included *Atlantis*'s launch, a videotape of the Gamma Ray Observatory's Payload Operations and Control Center at Goddard, and even an amateur video production.

During the first fast-scan uplink, *Atlantis* was not able to get a viewable picture, probably because of the orbiter's attitude. On the second and third attempts, the video uplink stations at Long Beach, Goddard, Marshall, and Schaumburg were able to uplink live video to the astronauts.

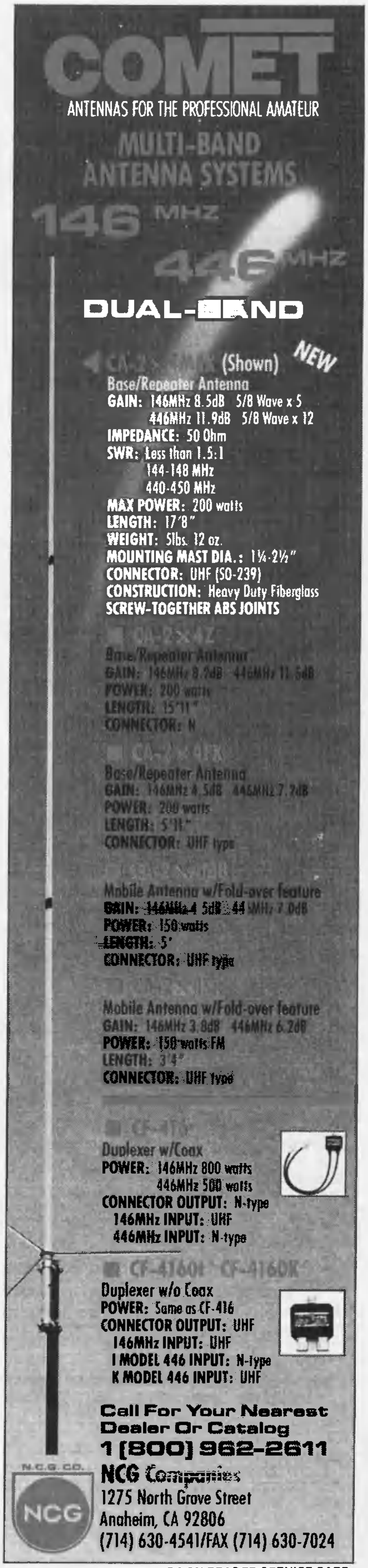
A Bonus Day

The deployment of the Gamma Ray Observatory and the spacewalk went fine, and *Atlantis*'s crew packed up their crew cabin to prepare for a landing on Wednesday April 10th. Unfortunately, the weather wasn't cooperating and the winds were too high. Flight controllers decided to keep the shuttle up for another day and wait for the weather to improve. There wasn't enough time to justify opening up most of the other experiments for just one more flight day, but the astronauts did take out the SAREX handheld transceiver and several cameras to take additional pictures of the earth. The bonus day resulted in *Atlantis*'s crew time being almost completely dedicated to amateur radio and unplanned QSOs! A couple of hams have kidded that SAREX got promoted from a secondary payload up to primary! Unfortunately for U.S. hams, the passes during that bonus day were primarily over South America and Africa. The next morning the crew was ready to come home again, and the weather cooperated. *Atlantis* landed at 6:55:29 AM PDT, 28 minutes short of a six day mission.

A Memorable Mission

During *Atlantis*'s 93 orbits, the five astronauts had talked with lots of hams and students around the world, received live video, and accomplished the first direct communications between a U.S. and a Soviet spacecraft. If they had only stayed up long enough for me to make a successful QSO (sigh)! 73

Contact Philip Chien KC4YER at 4340 S. Hopkins Ave. #40, Titusville FL 32780.



CIRCLE 54 ON READER SERVICE CARD

Software for the Ham Shack, Part III

Useful ham calculations you can program yourself!

by Bill Clarke WA4BLC

Another month has passed, and it's time for Part III in this series. By now you have become used to working with the formulas you added to the system last month. Using a computer for mathematical computations sure does make life easy.

Let's add a little more to the system. This month the MAIN MENU will grow to seven choices. Added will be:

6 - RADIO HORIZONS
7 - OHMS TO RESISTOR COLORS

Module Six

Figuring VHF/UHF ground waves is important when installing home and repeater antennas. The maximum usable distance for ground waves depends on the height of the antenna. This module asks for the antenna's height, then gives the maximum ground wave in miles. The figures are for flat terrain with the receiver at ground level.

Module Seven

Ever start a small project and list all the resistors you'll need, then have to stop and figure out the color codes? This handy module asks for the resistor value in ohms, then gives you the colors of the bands you will want to look for.

Entering the Listing

Before you add program lines from this month's listing, you must first LOAD "HAM2". After it's loaded, LIST it. Then you're ready to start typing. As before, don't worry if some of the lines appear out of order. The computer will straighten everything out.

Note modifications for the C-64 (see the listing).

After you have completed typing in all the lines, SAVE your work under the name HAM3.

Using the New Program

Load the new program by typing LOAD "HAM3" and pressing ENTER. When the computer signals READY on the screen, type RUN and press ENTER. This should be old hat by now.

The next thing you should see is the MAIN MENU for your new Ham System. It now shows seven selections: ANTENNA DESIGN MATH, TRANSMISSION LINE MATH, OHM'S LAW, POWER FORMULAS, EFFICIENCY FORMULA, RADIO

C-64 Modifications for HAM3

Don't forget about the modifications listed in Part 1 for C-64 users, and the following:

Replace the listed lines as follows:

```
610 INPUT "ANTENNA HEIGHT IN FT";H
616 PRINT "MAX HORIZ DISTANCE IS: "FNA(D)" MI"
731 PRINT "THE RESISTOR COLOR BANDS ARE:"
732 PRINT F$"/"S$"/"T$
```

Listing for HAM3

```
19 PRINT SPACE$(26);"6 - RADIO HORIZON"
20 PRINT SPACE$(26);"7 - OHMS TO RESISTOR COLORS"
37 IF M$ = "6" THEN 600
38 IF M$ = "7" THEN 700
600 CLEAR : CLS
601 PRINT SPACE$(26);"RADIO HORIZON"
602 PRINT SPACE$(20);"-----------------------------"
603 PRINT : PRINT : PRINT
610 INPUT "THE HEIGHT OF YOUR VHF/UHF ANTENNA IN FEET";H
611 A = 3*1.33*H
612 B = A/2
613 D = SQR(B)
614 GOSUB 390
615 PRINT : PRINT
616 PRINT "MAXIMUM HORIZONTAL DISTANCE IS: "FNA(D)" MILES"
620 PRINT
621 PRINT "N - TRY AGAIN"
622 PRINT "M - MAIN MENU"
623 M$ = INKEY$
624 IF M$ = "N" THEN 600
625 IF M$ = "M" THEN 10
626 GOTO 623
700 CLEAR : CLS
701 PRINT SPACE$(25);"RESISTOR COLOR CODES"
702 PRINT SPACE$(20);"-------------------------------"
703 PRINT : PRINT : PRINT
710 INPUT "THE RESISTANCE YOU WANT IN OHMS";R$
711 A$ = LEFT$(R$,1)
712 B$ = MID$(R$,2,1)
713 X$ = A$
714 GOSUB 751
715 F$ = C$
716 X$ = B$
717 GOSUB 751
718 S$ = C$
719 C = LEN(R$)
720 T = C-2
721 GOSUB 771
722 T$ = M$
```

Program listing.

The Megaloop

Continued from page 30

and it might be expected that much of the electromagnetic field would radiate off along this part of the loop before reaching the parts running north-south. See Figure 5. I tried testing this directional effect, favoring east and west on 10 and 15 meters, but I didn't get any conclusive results.

The primary effect I was looking for was the diversity in the presence of multipath fading. This I did indeed observe, especially on the higher bands. But I wasn't surprised. Contacted stations reported less fading from my signal on the megaloop, compared to the verticals. I have experienced this advantage of geographically large antennas in the past, with the 880-foot long wire that I put up, and also with various kite-supported sloping longwires.

So what's the great advantage of a megaloop? For me, it was a chance to satisfy my megalomania, to do something before the real estate was no longer available. It was a temporary, wintertime antenna, and I'm glad my parents let me do all this experimenting there. I took the antenna down as soon as I had established that it worked; I didn't want this huge lightning attractor giving my mother anxiety all summer long. Now all that wire sits in the basement, awaiting some other grand project such as the 3/4 mile kite sloper . . . maybe. 73

You may write Stan Gibilisco W1GV at 871 S. Cleveland Avenue #12, St. Paul MN 55116. Please include an SASE for a reply.

Software for the Ham Shack

Continued from page 42

```
723 IF T$ = "" THEN 790
730 PRINT : PRINT : PRINT
731 PRINT "THE RESISTOR COLOR BANDS ARE: " F$"/ "S$"/ "T$
732 PRINT
740 PRINT "N - TRY AGAIN"
741 PRINT "M - MAIN MENU"
742 M$ = INKEY$
743 IF M$ = "N" THEN 700
744 IF M$ = "M" THEN 10
745 GOTO 742
751 IF X$ = "0" THEN C$ = "BLACK"
752 IF X$ = "1" THEN C$ = "BROWN"
753 IF X$ = "2" THEN C$ = "RED"
754 IF X$ = "3" THEN C$ = "ORANGE"
755 IF X$ = "4" THEN C$ = "YELLOW"
756 IF X$ = "5" THEN C$ = "GREEN"
757 IF X$ = "6" THEN C$ = "BLUE"
758 IF X$ = "7" THEN C$ = "VIOLET"
759 IF X$ = "8" THEN C$ = "GRAY"
760 IF X$ = "9" THEN C$ = "WHITE"
761 RETURN
771 IF T = 0 THEN M$ = "BLACK"
772 IF T = 1 THEN M$ = "BROWN"
773 IF T = 2 THEN M$ = "RED"
774 IF T = 3 THEN M$ = "ORANGE"
775 IF T = 4 THEN M$ = "YELLOW"
776 IF T = 5 THEN M$ = "GREEN"
777 IF T = 6 THEN M$ = "BLUE"
778 IF T = 7 THEN M$ = "VIOLET"
779 RETURN
790 PRINT : PRINT
791 PRINT "CANNOT PROCESS VALUE LESS THAN 10 OHMS"
792 GOTO 732
```

Program Listing

HORIZON, and OHMS TO RESISTOR COLORS.

Next month, in Part IV, you'll add the last two modules of Ham System to your software. See you then! 73

You may write Bill Clarke WA4BLC at RD#2 Box 455-A, Altamont NY 12009. Please include an SASE in you request information.

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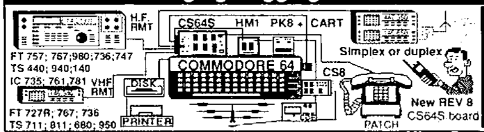

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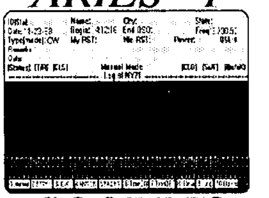
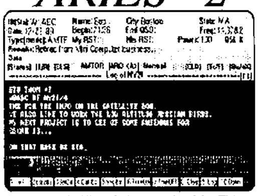


ARIES - 2



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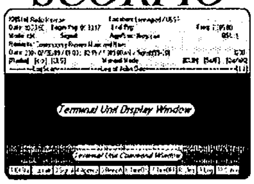

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CIRCLE 154 ON READER SERVICE CARD

73 Review

by Dick Goodman WA3USG

SSTV with the Robot 1200C Scan Converter and the Martin Emmerson EPROM Version 4.0

Martin Emmerson G3OQD
6 Mount Hurst Rd.
Hayes, Bromley
Kent, England
Tel. (011) 44-81-462-4223
Price Class: EPROM Version 4.0, $140;
Crystal Oscillator Board, $60.
Cashier's check; Call or write for exact pricing.

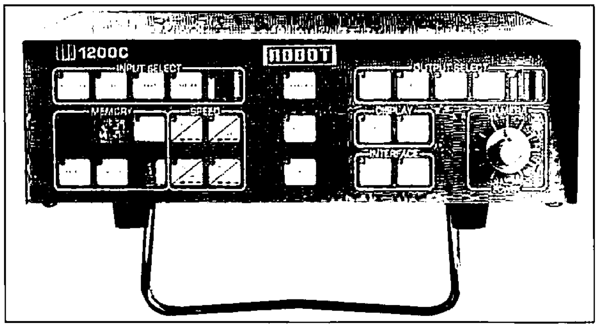

Photo A. The Robot 1200C scan converter.

Slow-scan television (SSTV) has evolved slowly but steadily in the last several years. Various transmission and reception standards have come and gone. Several companies have produced SSTV equipment and then disappeared from the scene. One company has been a mainstay in the field of SSTV: Robot Research of San Diego, California, manufacturer of the Robot 1200C scan converter (Photo A). While Robot's "bread and butter" is no longer in the amateur field, they still periodically schedule production runs of the 1200C.

Approximately three years ago, Ben Blish N4EJI (now AA7AS) created an SSTV system called the "Black Belt System," based on the Amiga 500/2000 computer. The Amiga Video Terminal (AVT) contains all current modes of SSTV, including those of Robot. It also includes its own special AVT protocol that proved superior to Robot. The complete AVT system is presently being marketed by AEA and is an excellent way to enter the wonderful world of SSTV. As new standards and protocols are developed, they may be easily incorporated into the AVT software.

There are other SSTV systems available. Research and development by other companies is moving at a dynamic pace, but at this time Robot and the AVT system are neck and neck in the forefront of SSTV technology. If there is an advantage of one system over the other, I would say it is in the field of marketing. The AVT system is being sold by AEA and other dealers. It has national advertising and support. Pick up a copy of virtually any amateur radio magazine and the AVT system will be advertised. Robot Research has limited exposure. The Robot 1200C is currently available from PC Electronics in Arcadia, California. Robot Research will also take orders directly at the factory.

With the impressive capability of the AVT system, its national exposure, and the ease of updates to the software, I felt that it was going to rapidly become the dominant SSTV format. Then Martin Emmerson G3OQD of Bromley, Kent, England, developed an updated EPROM for the Robot 1200C that incorporated virtually all existing SSTV modes including those used in the AVT system.

Robot 1200C Basics

The Robot 1200C scan converter is a complete, stand-alone SSTV system that requires only a video camera, radio transceiver, and television set (or video monitor) for operation. It does not require a computer. With these items, full color, high resolution pictures may be sent and received from virtually anywhere in the world.

Unfortunately, Robot decided not to support anything other than Robot modes of SSTV. This caused few problems when only Robot SSTV systems were available, but as time passed other systems were developed. An example of this is the Volker-Wrasse system used by European and other DX stations. This was incompatible with any Robot SSTV system, including the 1200C.

Even with these shortcomings, the Robot 1200C survived. While not as sophisticated as the AVT system, the Robot 1200C required very little additional equipment for its operation. It also contained a video digitizer that allowed grabbing full color frames from any video source. These frames may be stored in the Robot's internal memory and displayed on any television. The picture may also be transmitted, via the connected radio transceiver, anywhere that voice contact is possible. That's pretty impressive for a box about 11" x 4" x 12". The AVT system needs an Amiga computer along with the AVT SSTV hardware and software. If pictures from a video camera are to be sent, you must also get a video digitizer board and install it in the Amiga.

What makes the Robot 1200C incompatible with other SSTV systems is the program stored in its internal EPROM. But, this program could be rewritten to add other SSTV protocols, stored on a new EPROM, and put in place of the original Robot EPROM.

Modernizing the Robot 1200

The Martin Emmerson EPROM Version 4.0 (Photo B) contains all existing Robot modes

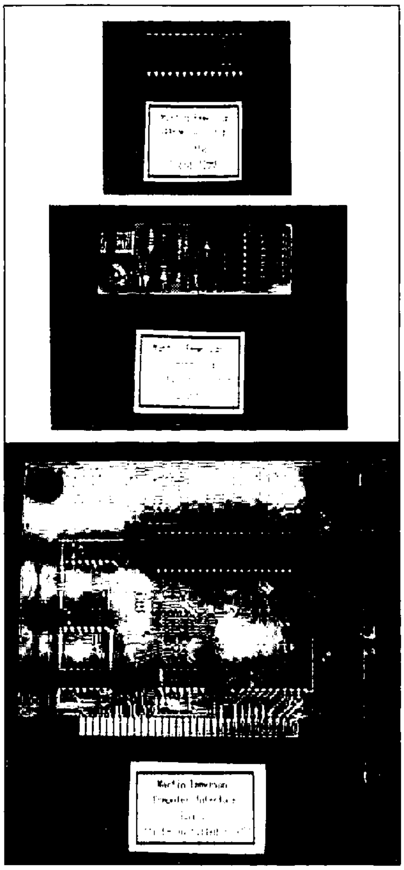
Photo B. The Martin Emmerson EPROM Version 4.0, crystal controlled oscillator board and the optional parallel port board for the IBM PC.

and virtually all current SSTV formats used anywhere in the world! Its additional features may be controlled from the front panel of the Robot 1200C, or operated remotely with enhanced features via computer control. It should be stressed, however, that a computer is *not* necessary to use any of the new SSTV modes.

To take advantage of all the features of the new EPROM, the Robot 1200C must be modified. The procedure is not difficult but, as with all Robot-related modifications, documentation is difficult to come by.

The procedure is basically threefold. First, unplug the original Robot EPROM and plug in the new Version 4.0 EPROM in its place. Second, install a crystal-controlled oscillator board (see Photo B). This involves removing a chip from the Robot, plugging the oscillator board into the empty socket, and placing the removed chip in a socket provided on the oscillator board. Third, replace all 64K memory chips in the Robot with 256K RAM ICs. This last modification also involves soldering a series of jumper wires to the Robot's motherboard, changing a jumper pin, and replacing an IC. Depending on the production run of the Robot, the IC may have to be unsoldered. The entire modification took me about two hours (I had to unsolder the IC).

Once the modification is complete, the Robot has the capability to store four high resolution color pictures in its internal memory (instead of one picture). This memory can also be used by Robot control programs (with an IBM compatible computer) for truly spectacular capabilities and special effects. More about this later.

The Emmerson EPROM

I ordered the Martin Emmerson EPROM directly from Mr. Emmerson in England. It took about six weeks to arrive as it was just coming out of beta testing. The EPROM is customized with your callsign, so it can be used only by the owner. It is apparent that Mr. Emmerson put quite a bit of effort into the development of the program on this EPROM. This "customizing" will prevent users from copying the EPROM and passing it on (unless you want others on the air displaying your callsign). I feel that the price for this chip is in line with what it will do.

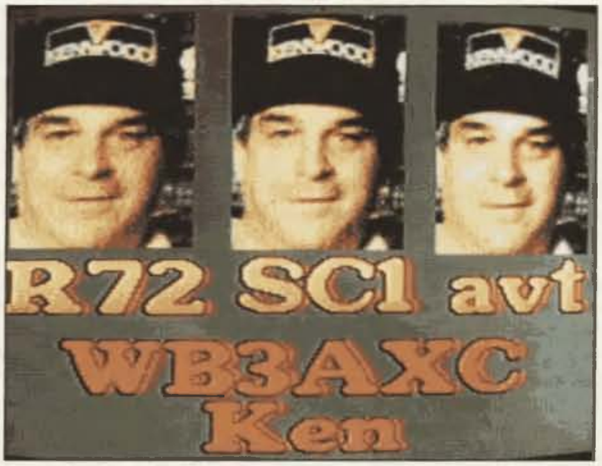

Photo C. Comparisons of Robot 72-second, Scottie SC1 and AVT 94-second pictures as received over a noisy UHF FM path. (This display and labelling was done with the Hi-Res 1.4 control program.)

Photo D. SSTV reception from Jim K4TGC on 14.233 MHz, using 36-second Robot protocol.

Photo E. WA3USG's family, transmitted on 2 meters and relayed back over a 35-mile path.

I also ordered the crystal oscillator board from Mr. Emmerson. The EPROM and oscillator board arrived intact from England, packaged ruggedly for shipment. The documentation provided is adequate. It consists of 12 high quality typewritten pages and several diagrams. Installation instructions are reasonably clear. If you have any questions, get on 14.230 or 14.233 MHz and holler for help. I can almost guarantee that during virtually any waking hour, there will be someone on frequency who has performed this modification! Instructions are also provided for replacing the 64K RAM with 256K chips.

What will the Martin Emmerson Version 4.0 EPROM do, once it is installed and all modifications are complete? All Robot modes are left completely intact and functional, and you will have many new ones. The four Scottie (SC-1) modes are used by many DX stations and US stations. It is not unusual to hear stations exchanging pictures, using the Scottie modes for hours at a time. It is interesting to compare the Robot modes with that of Scottie. In almost every instance, a picture received will look noticeably better when received via the Scottie mode, as opposed to the Robot protocol.

There are also the Martin and Wraase modes. These are used primarily by DX stations and are not as popular as Scottie.

Finally, there are the AVT modes. Two are provided: the 94-second and the 188-second. Each of these modes has a QRM and narrow bandwidth toggle (as does the actual AVT system). Pictures sent and received in the AVT modes are, in my opinion, the best of all protocols! Noise and QRM affect the received picture much less noticeably than in the other modes.

While difficult to objectively quantify, I ran some experiments on a UHF path of about 35 miles. I used frequency modulation, and carefully controlled signal levels to yield approximately 50% quieting. The S-meter was constantly observed to assure compliance to a controlled standard. Ken Starck WB3AXC, using a Robot 1200C, digitized a picture of himself and sent it in Robot 72-second color, Scottie SC1, and AVT 94-second. Each picture was saved in one of the four internal Robot memories. Photo C shows the results of this experiment. The difference between these modes on HF using SSB are even more dramatic. Documenting and recording these differences is difficult, however, as conditions on HF change drastically from one moment to the next.

The Results

Perhaps the best thing about the Martin Emmerson EPROM is that it makes the Robot 100% compatible with virtually any SSTV standard in existence. The picture quality in any of these modes can be very good indeed. Photo D shows a picture received on 14.230 MHz from Jim K4TGC in Pulaski, Tennessee, using 36-second Robot protocol. Conditions were good and there was very little interference. Photo E is a relayed picture of

my family that I transmitted to another station on 2 meters. The other station, located about 35 miles away, stored my picture in the Robot's internal memory and sent it back.

The Robot 1200C with the Martin Emmerson EPROM really shines when used under the control of an IBM compatible computer and proper Robot control software. The Robot 1200C has a rear-mounted parallel port, using a DB-25 connector, that may be interfaced with a PC clone.

To take advantage of this feature, a special parallel interface board must be installed in your computer (Photo B). I purchased mine from Martin Emmerson, but as of this writing others may be available that will work equally well. *[Ed. Note: Another appropriate parallel interface board is the PIO-12 made by Keithley Metrabyte Corporation, 440 Myles Standish Blvd., Taunton MA 02780. Phone: (508) 880-3000.]*. Inquiring on 14.230 MHz will also yield information on other possible manufacturers. A cable connects the interface board in the computer to the Robot rear parallel connector.

There are several excellent Robot control programs on the market that are a subject in themselves. Basically, these programs allow the operator to enhance the operation of the Robot 1200C. Pictures saved in Robot memory may be manipulated, changed in size, and cut and pasted with other pictures. Pictures may also be saved as disk files for permanent storage and recall. Hits in the picture as a result of noise or fades may be eliminated or minimized.

Special test patterns and graphics may be called up and displayed and transmitted. The picture shown in Photo C was composed with a PC and a Robot control program called "Hi-Res, Version 1.4" by Tom Jenkins N9AMR. The Robot may also be commanded into transmit or receive, SSTV modes changed, and video inputs/outputs selected. Other popular control programs are SCAN (written by Bert Beyt W5ZR), SSTV (originally written by Jim Williams KC5VC, modified by G4UKL and now offered by Garnet "Beb" Bebermeyer WB0UNB) and IMAGE (offered by Dick Isely WD9GIG). These control programs offer different features and really expand the capabilities of the Robot 1200C.

In summary, the Robot 1200C is the only true stand-alone SSTV system available. With it, a video camera, and a transceiver, you have a complete SSTV system. All that is required is a connection to the receiver's audio, transmitter audio in, and video in from any video camera. A conventional color TV or video monitor will display the captured pictures.

The Robot 1200C is capable of capturing full color video frames from any NTSC color camera, such as a camcorder. It will also function well with monochrome cameras. It is possible, using red, blue, and green filters, to store and send full color pictures using only a monochrome camera. With the modifications described, it will hold up to four high resolution color images in its internal memory. These may be images received off the air, or images captured from your camera. It will store up to 12 low resolution images, such as eight-second black-and-white pictures. All SSTV modes may be selected from the front panel without a computer. The addition of the Martin Emmerson EPROM Version 4.0 has updated the Robot 1200C to a state-of-the-art SSTV system, second to none.

I would be happy to answer any questions in reference to the EPROM Version 4.0 or the Robot 1200C. I hope to hear some new voices on 14.230 or 14.233 MHz. SSTV takes place daily on these frequencies. Drop on by and give a call, someone will be there to help you. ■

Contact Dick Goodman WA3USG at 199 Maple Lane, Mechanicsburg PA 17055. Please send an SASE for any information you request.

Computer control options for the Robot 1200C

Hardware			
Parallel Board (for IBM PC control of the Robot)	Martin Emmerson Board (see address above) 75 English pounds, or equivalent		
Miscellaneous	256K memory chips @ $4 each, 18 required (various sources).		
SSTV Software (Robot 1200 control programs for the IBM PC or clone)			
Hi-Res, Version 1.4	$75	Tom Jenkins N9AMR, 5988 S. Keystone Ave., Indianapolis IN 46227. (317) 784-6118	
SCAN, Version 6.0	$20	Bert Beyt W5ZR, 301 Tampico St., New Iberia LA 70560	
SSTV	$20	Garnet Bebermeyer WB0UNB, 15 Almeda Ct., Fenton MO 63026. (314) 343-8122.	
IMAGE	$27	Dick Isely WD9GIG, 736 Fellow St., St. Charles IL 60174.	

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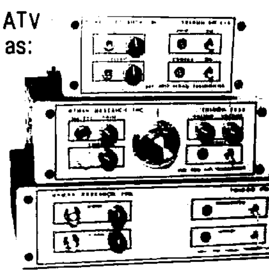

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2 450 TRANSCEIVER
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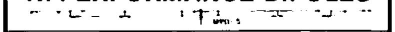

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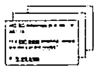

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73 Review

by Dave Pelaez AH2AR/8

Communication Concepts Inc.
508 Millstone Dr.
Xenia OH 45385
(513) 426-8600
Price Class: Kit, $50; Assembled, $70.

The ATV-3 Downconverter

Tune in to ATV with this economical kit.

Photo. The completed ATV-3 downconverter kit mounted in a case.

It's becoming more difficult to find companies willing to cater to the kit builder, but there are a few brave souls out there who have continued to supply project kits to those folks hopelessly addicted to rosin smoke. One of those companies is Communication Concepts, Inc., which has supplied many different types of linear amplifier and ATV-related kits to hobbyists for many years. Their ATV-3 GaAsFET Downconverter is a relatively new kit that has not received much fanfare.

The ATV-3 hooks up between your TV set and a good 70 cm antenna. With the ATV-3 in-line you can tune the entire 70 cm ATV band and convert it down to channel 3 or 4 on your TV. Although the converter tunes from 420–450 MHz, the commonly used ATV frequencies are 439.25, 434, 427.25, 426.25 and 421.25 MHz.

I discovered the ATV-3 after scouring the countryside for a reproducible kit for a group kit building session at our radio club. After putting together the kit from CCI, I was satisfied that it perfectly suited the requirements I had established for our kit building session: The quality of the double-sided printed circuit board and components is superb, and, most importantly, the sensitivity and performance of the finished product was much better than I expected!

Let's break out the magnifying glass and take a closer look at this kit.

Assembly

The total construction time ended up being about two hours. Due to the complexity of mounting several components, a beginner kit builder might want to get some help from someone a little more experienced in mounting the four surface mount capacitors and the two small toroidal inductors. Most of the other 52 components would not really pose a construction problem to a beginner. By following the step-by-step assembly instructions, and referring to the illustration, proper component placement is a breeze.

After helping to assemble 25 other circuit boards, I have cataloged a few possible "problem areas" that may be a concern to the novice kit builder. I talked with Roger Southworth, owner of CCI, and he plans to incorporate some of these suggestions in the next edition of the construction guide. Here, briefly, are my construction tips:

•The #30 gauge wire supplied for the 15-turn toroid inductor is the supplied red wire, and the #24 gauge wire for the 5-turn/3-turn toroid inductor is green.

•Q4, an MPSH-81 transistor, should be mounted as close to the printed circuit board as possible. Mounting this transistor at the prescribed height of ¼" may cause the transistor to "ring." It could also create a self-oscillation, causing a raster-type blank screen image to appear within the passband of a received ATV signal.

•Before soldering them on the circuit board, cut the leads short on the supplied MRF 966 and the MRF 901. This will make it easier to install the other components once the transistors have been soldered in place.

•The varicap diode, MV2205, is actually an MV2105. This will be corrected in the next printing of the instruction guide. In mounting the varicap diode, make sure that the flat part of the TO-92 case goes against the trimmer capacitor, C-23.

•The two "hairpin" type inductors are not drawn to scale. Be sure to follow the directions and make them 0.4" high off the printed circuit board. Their width can be governed by the pre-drilled holes in the printed circuit board.

•Keep all lead lengths as short as possible, including the lead lengths of the exposed center conductor of the 50 ohm transmission line.

•You might want to opt for purchasing a panel-mounted potentiometer. That way you can change ATV frequencies once you have mounted this circuit in a shielded enclosure.

•The "double balanced mixer," a rectangular can with eight pins, can be installed improperly if you're not careful. Once it is soldered in place, it would be almost impossible to remove it if you installed it backwards. There is a blue-colored alignment pin which is mentioned in the instructions. Follow these instructions carefully to ensure proper installation.

Alignment and Testing

If you have assembled the kit properly, a "smoke test" will certify your expert kit building techniques. The alignment process can be as important as making sure that the kit was assembled properly. If the kit falls off on performance, you can be almost certain that the kit has not been properly aligned. If you do not have a service monitor, it is absolutely imperative that you have a friend transmit an alignment signal on 70cm ATV. Do not attempt to align the downconverter with an ATV transmitter located in the next room—overloading the downconverter with a transmitter two feet away will make the alignment process frustrating, if not impossible.

Roger's suggestion of starting off with a commercial UHF signal as a means of rough alignment is helpful. Once you have found a commercial UHF signal and you step through the alignment procedures, ask a friend who has an ATV transmitter to supply an alignment signal (which is an order of magnitude weaker than a commercial station) for your final tweaking. If the transmitted signal is located a few miles away from your downconverter, this will help you in ensuring that the system is properly aligned and the downconverter is not being swamped.

By tuning capacitor C5, any commercial UHF television images can be effectively notched out. This adjustment may not be readily apparent, since C5 has literally no effect on the received 70cm signal. If images appear within the ATV range of the downconverter tuning potentiometer, this is the first setting to check in order to properly notch out these MEGA-ERP power television signals.

How Does It Work?

Out of the approximately 25 different hams who participated in the Dayton Amateur Radio Association kit building session, there wasn't a single dissatisfied customer. On-the-air tests with another commmercially available GaAsFET downconverter showed a slight edge when compared with the ATV-3 (weak signal reception). I couldn't see any detectable difference on stronger local signals. Even though I'm near several large commercial TV stations, the ATV-3 performs well with little interference from these stations.

This kit allows you to enjoy the best of both worlds. . . the chance to burn your fingers on the ol' soldering iron *AND* the satisfaction of constructing an extremely high-quality circuit.

Other Comments

This kit does not come with an enclosure or AC adapter. For the kit builders, I came up with a number of local sources for the hardware and chassis that we ultimately used for this project. For the type and size of enclosure you choose for your downconverter, you are limited only by your imagination. A simple power supply can be fabricated with a handful of junk box parts, or a visit to your local Radio Shack.

With kits still available from folks like Communication Concepts, the revered and esoteric art of electronic kit construction will remain alive and well. . . for those who love the smell of burning rosin flux in the morning!

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Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

A Mission of Firsts

The Shuttle Amateur Radio Experiment (SAREX) on the STS-37 *Atlantis* mission was a success, in spite of a broken wire precluding two-way packet and slow-scan television (SSTV) contacts with the crew. SAREX is a joint effort of NASA, the ARRL, AMSAT and the Johnson Space Center Amateur Radio Club.

On April 5 of this year, the first all-ham crew went to orbit with the Gamma-Ray Observatory (GRO), experimental "scooters" to be evaluated for future space-station use, and the most ambitious SAREX experiment to date. Amateur radio has two reasons to be included on shuttle flights. The first is to encourage public participation in the space program, and the second is to support educational opportunities derived from the voice and digital communications from space.

The crew included pilot Ken Cameron KB5AWP, commander Steve Nagel N5RAW, mission specialist Jerry Ross N5SCW, mission specialist Linda Godwin N5RAX, and mission specialist Jay Apt N5QWL. Ken, licensed since 1984 before coming to NASA, brought an enthusiasm to the SAREX program that was quickly shared by the other members of the STS-37 mission. Starting with Jay, the crew members took and passed their Technician-class tests. Linda became the first female ham in space.

Equipment Configuration

The ham gear on the *Atlantis* for STS-37 included an impressive array of equipment, such as a Motorola 2 meter hand-held transceiver, video and audio recorders, headset, color camera and monitor, fast-scan TV (FSTV) module, slow-scan TV (SSTV) scan converter, computer with tracking and packet software, packet module, window-mounted antenna system, and all the necessary cables to connect it together.

Amateur FSTV had never before been tried in space. This was a first, and it worked. The receive converter used by the crew measured only a few inches on a side. It connected to a Panasonic display and recorder unit, and to a small L-shaped antenna that was a part of the 2 meter loop antenna mounted with Velcro in one of the shuttle's flight-deck windows.

Some of the items in the equipment list had not been previously qualified for use on the shuttle. The Panasonic portable TV/VCR was one example. It resembles a lap-top computer with a flip-up video display and a VCR where a computer's keyboard would reside. The case is plastic, and considered inflammable. To qualify for flight, it was coated with a special foil and painted. The liquid-crystal display was tested to ensure that it would not shatter or come apart when hit with weights dropped from specific heights. It passed, and will likely be used on future flights.

The shuttle's ham antenna system acts like an outside-mounted quarter-wave whip, even though it is a shielded loop installed inside the shuttle. As with a whip antenna mounted on a large vehicle, there are signal nulls to contend with. If an automobile were placed in orbit with a roof-mounted antenna, reception from stations "under" the car would be poor. This occurs often with the shuttle whose orientation, with respect to stations on the earth, is constantly changing.

The packet system used on STS-37 was the same as that on the STS-35 flight. Several stations heard the beacon transmissions on 145.51 MHz from the *Atlantis*, but due to the broken wire in the cable between the scan converter and the radio, no audio from the radio got to the other equipment. Lou McFaddin W5DID inspected the cable after the mission, found the problem, and began repairs. The connection behind the plug to the scan converter apparently was flexed one too many times. The assembly will be potted and stiffened before it is used again, even though it had worked without problems on the previous flight and during many tests.

Photo A. STS-37 Atlantis *heads for space with an all-ham crew.*

Photo B. Gil Carman WA5NOM and students from the Clear Lake Independent School District communicate with the astronauts of STS-37.

The SSTV system also suffered from the broken wire, but even though pictures could not be uplinked to the shuttle via slow-scan, they could be sent to the ground. Many hams monitored the pictures sent from the shuttle via the heavily-modified ROBOT scan converter and 2 meter transceiver. On the third day of the mission, Ken KB5AWP configured the system to send "frame-grabbed" pictures of the extra-vehicular activity (EVA) of Jay N5QWL and Jerry N5SCW working on the GRO high-gain antenna.

Space-Bound "Real" TV

Earth-to-space frequencies on 70 cm are limited to only 3 MHz. For the flight of STS-37, several stations were given permission by the FCC to send normal (at least 6 MHz wide) TV to the shuttle. Jim Steffen KC6A was the first to have his transmission received on the shuttle. While SSTV had been used for uplink experiments years ago on a shuttle mission with Tony England WØORE, this was the first time for wideband fast-scan TV. With 14 kW effective radiated power, Jim's pictures came through very well throughout most of the pass.

Andy Bachler N9AB sent a video of the shuttle's launch up to space allowing the crew to see their own liftoff via the Amateur FSTV link while still in orbit. This was another first. Others, including the Marshall Amateur Radio Club (WA4NZD) and the Goddard Space Flight Center Amateur Radio Club (WA3NAN transmitting via a 40 foot dish at the US Naval Academy at Annapolis, Maryland, manned by Bob WB4APR), successfully sent video to the shuttle. For terrestrial ATV activity, large antennas are used on both ends of long-distance contacts. With only the equivalent of a small whip antenna on the shuttle, the sending station on the ground needed to overcome the limitations of the shuttle's antenna as well as the distance penalty. Antennas planned for the space station later this decade should be better.

Continued on page 75

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HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
P.O. Box 2508
Fullerton CA 92633

Three-Second T-Hunts

Remember those spy movies and TV shows where the good guys hide a transmitter on the bad guys' car and tail them to their hideaway? The best tracking gizmos featured a little screen with a moving map on it. The car with the crooks (or enemy agents, or whatever) would appear as a blinking dot on the hero's map screen.

I'm sure that back then these stories helped fuel the paranoia of people who were positive that their every move was being monitored by trench-coat-wearing agents in panel trucks. But we T-hunters knew it couldn't be done that easily. Ordinary Radio Direction Finding (RDF) sets "display only incoming signal azimuth," plus a rough idea of distance. No single tracking device can pinpoint a vehicle down to within a few feet. Multiple-station triangulation normally is not precise enough either, because small angular bearing variations from any station cause significant triangulation error.

Well, it's not science fiction anymore. Welcome to the nineties, and what promises to be the decade of super-accurate Automatic Vehicle Monitoring (AVM). International Teletrac Systems is the first to bring AVM to market, starting in Los Angeles. The network is in place, dealers are ready, and ads are appearing on TV.

A minor media war is going on between Teletrac and LoJack (see "Homing In," May 1991) for the stolen vehicle recovery market. Their technologies have major differences. VHF/UHF AVM systems like Teletrac use no directional arrays, loops, or beams. There are no Doppler homing units. Instead, AVM uses a wide-aperture, time-difference-of-arrival (TDOA) system.

Previous "Homing In" columns (September and November 1989) have described TDOA transmitter hunting techniques for hams, but they have all used narrow aperture (less than one-half wavelength) antenna spacing. AVM antenna spacings are measured in miles instead of inches.

Teletrac Versus Thieves

For a fixed price plus a monthly service fee, a Teletrac contractor will install a chalkboard-eraser-sized AVM transponder in an inconspicuous spot in your car. These transponders, called Vehicle Locator Units (VLUs), are manufactured under license by several Japanese firms.

The VLU contains logic to detect startup by an unauthorized person. It taps into the key warning buzzer circuit and other available signals. If a thief starts the car without a key, or trips any other alarm devices on the car, the VLU transmits its "I'm being stolen" digital message and an ID number to Teletrac's control center computer. The computer immediately issues a "location request" to start the RDF process.

Receiving a location request transmission makes the VLU switch from the "alert" channel to one of the many "location" channels and send out a transmission burst. All receiver sites listen for the burst and pass along what they hear (time of signal, the strength, and ID) to the control computer. The computer selects the four strongest site signals and looks at the differences in their time of arrival. Using an advanced RDF technique called multilateration, it locates the source of the signal.

About three seconds after the request transmission, the number crunching is completed and the computer displays the location of the vehicle as a mark on a computer-generated map (see Photo A). Accuracy is typically within 100 feet. As the thief drives away, the system issues more location requests and calculates the speed and direction.

After notifying the owner and/or authorities as appropriate, Teletrac operators continue to follow the stolen car. They update law enforcement agencies by phone, or send computer data to police/sheriff computer screens. All the while, the computer is recording the path on disk for possible court use as evidence. If another crime is committed en route, this record becomes even more important.

Note that none of the receiver sites have directional antennas or any other way to independently determine the direction of incoming signals. Direction of arrival at each site is unimportant; only the relative times of arrival are required to locate the transmission.

Even with antennas spaced many miles apart, time of arrival differences are measured in nanoseconds (billionths of a second). This means that the transmissions must be very short to ensure RDF accuracy. It takes precise timing and a fast computer. The first of the four receivers is used as a time reference and the other three sites give relative time information.

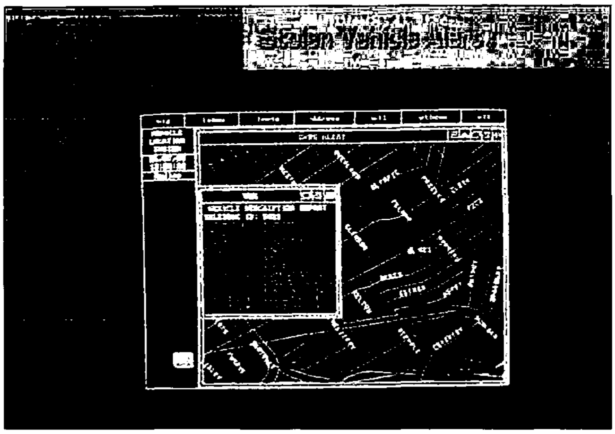


Photo A. Teletrac claims 100-foot accuracy with its vehicle location system.

Teletrac to Hams: Stay Off 70% of 33 Centimeters

The advent of AVM directly affects amateur radio, because it is taking place in our 902 to 928 MHz ham band. From the time hams first received a 33cm allocation, it has always been on a shared basis. The FCC established the priorities as follows:

1. Military radiolocation
2. Industrial/Scientific/Medical (ISM)
3. Government
4. Automatic Vehicle Monitoring
5. Amateur Radio
6. Low-power (Part 15) devices

Hams must not cause interference to the military, government, and AVM.

They must accept any QRM received from military, ISM, government, and AVM on this band. (ISM is a transmit-only service.)

Two years ago, Southern California hams were beginning to discover the usefulness of 902 to 928 MHz. A few repeaters and links were being tested, an ATV network was already working, and advanced experimenters were trying wideband high-speed digital message forwarding. Then Pacific Telesis announced the start of AVM testing. At a meeting between Pac-Tel and the Southern California Repeater and Remote Base Association technical committee (SCRRBA) in January 1990. Pac-Tel made it clear that interference from hams would adversely affect its Teletrac network.

As a result, the SCRRBA suspended all coordination on the 33cm AVM segments, and wrote a new band plan. In the new plan, weak signal work and repeater inputs are placed from 902 to 903 MHz. Amateur links and repeater transmitters on mountaintops and at other communications sites are being coordinated from 927 to 928 MHz, adjacent to the high power paging transmitters that are proliferating above 928 MHz. Putting weak signal ham operations at the low end of the band minimizes QRM from the paging systems.

No ham activities are being coordinated in the 903 to 912 and 918 to 927 MHz ranges, keeping them clear for AVM. Amateur television users have been coordinated on one simplex channel, with a video carrier at 913.25 MHz. *[Ed. Note: In Los Angeles, 919.25 MHz is now being used for an ATV repeater output. Two are currently operational.]*

Vestigial sideband is recommended to keep lower sideband energy from affecting AVM receivers near 912 MHz. If the FCC authorizes AVM systems between 912 and 918 MHz, this band plan may have to be changed.

According to the SCRRBA Data Base Manager Karl Pagel N6BVU, other coordinating committees around the country are inquiring about the new Southern California band plan, as Teletrac and other companies expand operations nationwide. As the AVM system expands into other major U.S. cities, don't be surprised if this plan is used for your area.

Climb Every Mountain

To cover its 4,500 square mile service area in four Southern California counties, Pac-Tel Teletrac has installed 41 receiving sites. They are not at those familiar cellular phone towers along the freeways. Instead, they are on the area's high hills and mountains, to give maximum coverage. More sites are being added to fill coverage "holes" due to shadowing in foothill areas.

The computer program is designed to calculate the location of 70 vehicles each second. Of course there aren't that many AVM-equipped stolen cars out there at one time (even in Los Angeles). The additional capacity is sold to large companies and public service agencies so they can keep constant track of all their vehicles.

Owners of large truck fleets are looking to AVM to save money by more efficient routing and elimination of empty-load runs. Putting AVM into law enforcement vehicles would allow dispatchers to instantly know which squad car is closest to the scene of an emergency.

But AVM has potential far beyond fleet management and recovery of stolen vehicles. The technology behind Teletrac was originally inspired by a well-publicized kidnapping in Florida. Teletrac marketeers say that its inventors originally set out to develop a personal tracking system to prevent similar tragedies.

Miniaturized transponders for that purpose are not here yet, but they are probably not far off.

Also in the works is a "panic button," so Teletrac owners can call for help from their cars. Designers are even considering a remote disable feature, to permit authorities to flash the lights, honk the horn, or even stop the engine when you report your car stolen.

AVM system designers have their technical problems, of course. They may be able to keep hams off their frequencies (see sidebar), but they must accept interference from other users. Military radiolocation transmitters have caused big-time QRM at high AVM receiver sites.

Industrial emitters can cause headaches, too. For instance, those anti-theft devices at the doorways of record stores can jam an AVM site under some circumstances. New state-of-the-art receivers are solving these problems.

Big Brother?

It's eleven o'clock—do you know where your car is? Teletrac owners can find out in seconds by dialing up a special phone number and giving their ID and password. I can hear it now: "Dad, can I have the keys tonight? Not for your sports car, I want the old wreck without the Teletrac!"

But don't get the idea you can use Teletrac to "bug" someone else's car. The installer is supposed to see proof of registration before installing a VLU.

The AVM market is taking off. Teletrac is going into Chicago, Detroit and Dallas/Ft. Worth this year. Miami, New York and New Jersey are scheduled for next year. Hams with a technical background in RF are finding jobs in installation and maintenance of the dozens of sites required for each system.

Teletrac has over two dozen software engineers on staff—it's a BIG computer program. Furthermore, numerous other companies are eyeing the AVM scene and making FCC applications. Perhaps there is a place for you in the AVM field.

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

JUL 4

HARRISBURG, PA The Harrisburg RAC will sponsor a Flea Market at the Bressler Picnic Grounds, Exit #1 of I 283, PA 441 North, and follow signs. Admission $3. Tailgating $3. Tables in pavillion $10 in advance, $12 at the gate. Set-up at 6 AM for vendors and tailgating. No overnight camping. Talk-in: 147.30/.90 and 52/52. Contact ***Dave Dormer KC3MG, (717) 939-4957.***

JUL 5

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg. beginning at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in on 147.300. Contact ***John Patchett KB2ERJ, (315) 487-0298.*** Please bring two forms of ID and a copy of your license.

JUL 6

SALISBURY, NC A Firecracker Hamfest, sponsored by the North Carolina Chapter of Triple States RAC, will be held at the Civic Center from 8 AM-4 PM. Advance tickets $3, $4 at the door. Tables $5. W5YE VE Exams at 1:30 PM; pre-register by sending 610, copy of license and $5.25 fee to ***Isabell Ledford, PO Box 826, Collamee NC 27014.*** For advance tickets contact ***Walter Bastow N4KVF, 3045 Highrock Rd., Gold Hill NC 28071.***

OAK CREEK, WI The South Milwaukee ARC will hold its 21st annual "SWAPFEST" at the American Legion Post #434 in Oak Creek WI from 7 AM-2 PM. Free overnight camping. Admission $4. Talk-in: 146.580 MHz FM simplex and most local repeater frequencies. For more details and a map, write to ***The South Milwaukee ARC, PO Box 102, South Milwaukee WI 53172-0102.***

JUL 6-7

WESTON, WV The West Virginia State ARRL Convention, sponsored by the West Virginia State AR Council, will be held at the Jackson's Mill State 4-H Camp near Weston, WV beginning at 8 AM both days. Set-up Fri. from 5:30 PM-11 PM. Admission $5. Flea market tables free (admission ticket required). ARRL VE Exams at 8 AM Sat. Contact ***Bob Robinson KU8C, (304) 366-0132*** by June 30 to pre-register.. Talk-in: 144.79/145.39. For advance tickets write ***Sue Goodwin N8JNL, 103 Cleveland Ave., Nitro WV 25143.*** For info call ***Chuck McClain K8UQY, (304) 366-5401.***

JUL 7

PITTSBURGH, PA The North Hills ARC of Pittsburgh PA will hold its sixth annual Hamfest from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd., between US Rt. 19 North and McKnight Rd., north of Pittsburgh. Free admission. Free tailgating-one space/vendor. Wheelchair accessible. Limited indoor tables $10 each. Contact ***N3DOK, (412) 367-2393*** for table info.

JUL 9-19

IRELAND Final arrangements have been completed for the first expedition to Fastnet Rock Lighthouse off the South coast of Ireland. Callsign EJ7FRL has been assigned. For info contact ***EI3GU, 31 Seaview Park, Shankill, Co. Dublin, Ireland.***

JUL 12-13

MAPLEWOOD, MI Amateur Fair '91 will be held at the Aldrich Arena. This event is oriented to amateur radio operators, electronics hobbyists and personal computer users. Outside flea market and commercial exhibits start at 6 PM Fri. On Sat. the flea market will be from 6 AM-3:30 PM; Commercial exhibits 8 AM-3:30 PM. Admission is $5 at the door. Children under 6 admitted free when accompanied by an adult. Ticket holders may sell from the giant outdoor flea market at no additional cost. For commercial booth and club exhibit info contact ***Amateur Fair, PO Box 26331, St. Paul MN 55126***, or call ***(612) 653-9999.*** Computer users can call ***HAM-LINK*** at ***(612) 426-0000*** (300-2400 baud).

JUL 12-14

NORTH DAKOTA/MANITOBA BORDER North Dakota and Manitoba's 28th annual Hamfest will be held at the Peace Garden on the USA-Canadian border. Registration begins on the afternoon of the 12th. The Hamfest will end about noon on the 14th. Breakfast for all will be on Sun. morning. Special Event Station VE4IHF/Ø will operate Fri. and Sat. Ample camping spots on-site. The Peace Garden is located just a few miles north of Dunseth ND, or a few miles south of Boissevain, Manitoba.

JUL 13

PETOSKEY, MI The Straits Area ARC will sponsor a Swap Shop at the Emmet County Fairgrounds 4-H Building from 8 AM-1 PM. Tables $3-Door $2.50. RV parking on grounds. Talk-in: .08-.68 or .52. For general info/reservations contact ***Clark Rouse KA8TIL, (616) 582-6455.*** VE Exams contact ***Tom Romanauski N8KHE, (616) 436-5033.***

JUL 13-14

WOODLANK PARK, CO The Mountain ARC will hold a Flea Market Swap 'N Shop at the Red Rocks Campground, Pike National Forest. Camping in the pines; entry for camping or set-up permitted late afternoon of July 12th. Advance reservations required for overnight camping. For camping reservations write to ***MARC, Box 1012, Woodland Park CO 80866***, or call ***Joe Tafoya NØCMD, (719) 687-3641*** or ***Bob Whipple N/0FCR, (719) 687-9025.*** Free admission. Camping $7.50 per night. Tailgate space $7.50 per space (no double fee if camping and selling).

INDIANAPOLIS, IN Indianapolis Hamfest/Computer Show (Indiana's largest electronic, amateur radio and computer related market and flea market) will be sponsored by the Indianapolis Hamfest Assn. This will be held at the Marion County Fair Grounds at the intersection of I-465 and I-74 on the southeast side of Indianapolis. The show is open from 7 AM-4:30 PM both days. Tickets $8 at the gate, $6 in advance. For info call ***(317) 326-2146.*** Mailing address: ***Indianapolis Amateur Radio Assn., PO Box 11776, Indianapolis IN 46201.***

JUL 14

DOWNERS GROVE, IL The DuPage ARC will hold their 9th annual Hamfest/Electronics/Computer Show at the American Legion Post 80. Free parking. VE Exams $5.25 for all classes except Novice, which is free. Walk-ins welcome. Tickets $3 in advance, $4 at the gate. Set-up at 6 AM. Gates open to the public at 8 AM. Talk-in: 145.250/.600, 224.68/1.6, 442.55+5 PL114.8. For reservations, send SASE to ***Hamfest Chairman W9DUP, PO Box 71, Clarendon Hills IL 60514.*** For info call ***Ed Weinstein WD9AYR, (708) 985-9256.***

BOWLING GREEN, OH The Wood County ARC will sponsor its 1991 Ham-A-Rama at the Wood County Fairgrounds on Poe Rd. from 8 AM. Tickets $4 in advance, $5 at the door. Tables $10. Talk-in: 147.78/.18 K8TIH. For tables, info, contact ***Bob Fyfe KA8YWQ, (419) 352-3260.***

AUGUST, NJ The Sussex County ARC will hold a Hamfest, beginning at 8 AM, at the Sussex County Fairgrounds, Plains Rd., off Rte. 206. Free parking. Admission $4 (XYL's and harmonics free). Tailgate $6, indoor spaces $8 per space. Limited supply of tables. Talk-in: 147.90/.30, 222.90/224.50, 146.52. Contact ***Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849. (201) 663-0677.***

JUL 18-20

CHARLOTTE, NC Personal Computer Interfacing-Practical Instrument Automation, Networking and Control Techniques, including microcontrollers. A 3-day hands-on workshop. Contact ***Dr. Roy Jones, (703) 231-5242 or (703) 231-6478.***

JUL 20

SOUTH BURLINGTON, VT The Northern Vermont Mid-Summer Hamfest Committe will sponsor a Hamfest at the South Burlington Middle School from 8 AM-3 PM. Admission $3 (US). VE Exams at 2 PM. Tables available. Talk-in: 145.47/-600 or 146.85/±600. Contact ***Joe Tymecki N1DMP, (802) 893-6458*** or ***Tom Taylor N1EXY (802) 893-4834.***

UNION, ME The 4th annual Union Hamfest/Computer Fair, sponsored by the Maine Hamfest Assn. Inc. will be held at Union Fairgrounds on Rte. 17 from 8 AM-2 PM. Admission $2 for sellers; $3 for non-sellers. Tailgate set-up begins at 7 AM. Free parking. FCC VE Exams. Camping/RV spaces available for Fri. the 19th and Sat. the 20th. Contact ***Rod Scribner KA1RFD, 19 South Grove St., Augusta ME 04330. (207) 622-9197.***

GARDEN GROVE, CA The Catalina ARA will sponsor Hamfest '91 at Cypress College from 8:30 AM-5 PM. Contact ***CARA, PO Box 425, Garden Grove CA 92642-0425.*** (Vendors, please request vendor information).

JUL 21

WASHINGTON, MO The Zero Beaters ARC will hold its 29th annual Hamfest at the Bernie H. Hillerman Park (Washington Fairgrounds) from 6 AM-3 PM. Admission is free. Flea Market parking is $2 a space. Walk-in VE Exams begin at 10 AM. Bring original license and a photocopy. Talk-in: 147.240 repeater. Contact ***Ed Southall WDØELL, Rt. 1 Box 105, New Haven MO 63068. (314) 459-8581.***

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society and the Harvard Wireless Club will hold a Tailgate Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at Albany and Main Streets in Cambridge. Admission $1.50. Free off-street parking. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. For space reservations or info call ***(617) 253-3776.*** Mail advance reservations before the 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** Talk-in: 146.52 and 449.725/444.725-pl 2A-W1XM/R.

JUL 25-28

CEDAR RAPIDS, IA The 25th Central States VHF Society Conference will be held at the Sheraton Inn. This event is for all VHF/UHF/SHF operators. Pre-registration forms are available from ***Al Groff KØVM, 1446 Council St. NE, Cedar Rapids IA 52402. Home phone (319) 393-8134.*** Make hotel reservations by calling the ***Sheraton Inn at (800) 325-3525*** or ***(319) 366-8671.*** To obtain the special room rate, be sure to indicate that the reservation is being made for the CSVHFS Conference.

JUL 26-28

FLAGSTAFF, AZ The Amateur Radio Council of Arizona will sponsor the Fort Tuthill Hamfest at the Ft. Tuthill County Fairgrounds. Camping facilities for self-contained campers. No power supplied. $5 per night inside fenced area. Tailgate fee is $10. Tickets $2 each or 3/$5. VE Exams on Sat. Talk-in: 147.68/.88, 447.125/442.125. For info contact ***Chairman, Lee Pemberton WB7BXB, 759-8737*** or ***Vice Chairman, Cliff Hauser KD6XH, 744-9095.***

LANCASTER, PA The Red Rose Repeater Assn., Inc. will sponsor a Computer Fest at the McCaskey High School from 9 AM-3 PM. Set-up at 7 AM. Admission $4 with children under 14 free if accompanied by a paying adult. Talk-in 147.015/.615. Mail ***Red Rose Repeater Assn., Inc., PO Box 8316, Lancaster PA 17604.***

JUL 27

NORTH BEND, OR The Coos County Radio Club will sponsor a Radio/Computer/Electronics Swap Fest at the North Bend Jr. High School from 0900Z-1700Z. Free RV/SC parking all week end. VE Exams. Advance tickets $4, $5 at the door. Tables (8' x 30") $15. Commercial Space @ $30.00. Only one free admission per seller, regardless of number of tables. Set-up July 26th, 3PM-6 PM; July 27th, 6 AM-9 AM. Make checks payable to ***Coos County Radio Club, PO Box 349, Coos Bay OR 97420.***

JUL 27-28

OKLAHOMA CITY, OK The 18th Annual Ham Holiday 1991 and ARRL Convention, sponsored by Central Oklahoma Radio Amateurs, will be held at the Hobbies, Arts & Crafts Bldg, Oklahoma State Fair Park. Doors open at 8 AM both days. VE Exams both days. Saturday evening banquet (Tickets $8.50); Flea market, new and used equipment, forums. Admission $6 in advance or $8 at the door. Tables $5 in advance, $7 at the door. Talk-in on 147.03/.63 and 444.20/449.20, PL is 141.3. Send registration to ***CORA Ham Holiday 1991, PO Box 95942, Oklahoma City OK 73143-5942.***

JUL 28

TIMONIUM, MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State Fairgrounds. Set-up at 2PM Sat. and 6 AM Sun. There is no set opening hour. 8' tables (no power) are $25 each. Write or call for special discount rates for 10 or more tables. Tailgating is $5 per space, on sale on the day of the hamfest. Free VE Exams will be held in the Administration bldg. at 10 AM only. Pre-registration required. For exam info and reservations write to ***BARC, PO Box 120, Reisterstown MD 21136.*** For table reservations and hamfest info write to ***BRATS Hamfest, PO Box 5915, Baltimore MD 21208***, or call ***Franz N3HFS, (301) 583-9147***, 24 hours a day.

SPECIAL EVENT STATIONS

JULY

VERMONT Vermont Special Event Stations will operate 25 kHz up from the bottom of the Novice and General band throughout the year, to help Vermont celebrate its 200th Birthday. RTTY/AMTOR/etc. will be in the digital sub-bands. To obtain a Special Certificate, send $1 and SASE to ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.*** Foreign stations, send only SAE and IRC's to cover postage.

JUL 4-6

LOUISVILLE, KY Louisville's Freedom Hall will be the site from which Special Event Station W4CN will operate to celebrate the International Barbershop Singing Convention. Time: 1200-0300 UTC. Frequencies: 20-, 15- and 10 meter SSB, as well as 2 meter FM. Sideband frequencies will be 14.225/.245 MHz, 21.30/.32 MHz and 28.30/.32 MHz. FM operation will be on the Louisville 147.18 MHz repeater and 147.58 MHz simplex. Talk-in will begin on Monday, July 1st, on the repeater frequency. All amateurs contacting W4CN will receive a special commemorative QSL card, courtesy of Yaesu USA. The station is sponsored by members of the amateur Radio Transmitting Society of Louisville. Contact ***Gil Hibben N4LRF, Amateur Radio Transmitting Society, PO Box 7391, Louisville KY 40257-0391. (502) 222-1397*** (daytime).

JUL 6

DELTAVILLE, VA The Middlesex AR Group will operate KB4NGO, 1230-2030 UTC to commemorate Deltaville Heritage Days. Operation will be in the General portion of the 80, 40 and 20 meter bands. For certificate send QSL and SASE to ***Fay Smith KB4NGO, M.A.R.G., PO Box 88, Hardyville VA 23070.***

JUL 6-7

DELTA COUNTY, MI The Delta County ARS will celebrate its 20th Anniversary as an affiliate of the ARRL by operating Station K8ZAS from 1400-0100Z Sat. & Sun. Bands: 10, 15, 20, 40, 80 meter. Frequencies: 28.357, 21.357, 14.280, 7.280, 3.980; CW: Novice CW frequencies. Contact ***Denise, PO Box 923, Escanaba MI 49829.***

LAPORTE, MN The Cass-Hubbard County ARC will operate NØGFK 1500Z 6 July-0300Z 7 July, to honor WØLSC, W.C. Soderlund, formerly of Laporte High School, for writing the curriculum and teaching the First High School Radio Theory Class in Minnesota. The station will operate SSB in the General portion of the 75, 40, 20, 15 and 10 meter bands. Mr. Soderlund will participate as one of the operators while being the Reunion Guest of Honor at the 75th Anniversary of the High School. For certificate, send QSL and SASE to ***W6AAQ, Box 595, Esparto CA 95627-0595.***

JUL 10-11

VERMONT A Special Event Station will operate for the State Capitol Building. The hours are 10 AM-3 PM. The State of Vermont is also providing a special gift to be included with the certificate for those contacts made on the 10th and 11th. Contact ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654*** for more info.

JUL 11

PUAKO, HI The Big Island of Hawaii will experience a partial and total solar eclipse from 1630-1837Z. Members of the Big Island ARC will operate Station NH6ES from 0001-2400Z, at Puako HI (within the path of the eclipse). Operation will be in the Novice part of the 10 meter band and in the General segments of the other HF bands. Special QSL cards to those contacting NH6ES. QSL to: ***BIARC, PO Box 1938, Hilo HI 96721-1938.***

JUL 12-13

NORTH DAKOTA/MANITOBA BORDER Station VE4IHF will be operated from the International Peace Garden from 9 AM-6 PM CST. This year the Station will be on with digital modes as much as possible, as well as phone. For a Peace Garden certificate, send 2 IRC and SASE or 1 IRC, SASE and QSL card, to ***Dave Snydal VE4XN, 25 Queens Crescent, Brandon, Manitoba, Canada R7B 1G1.***

JUL 13

WESTON, WV In conjunction with the X-Mas in July celebration at Weston Hospital, the Central ARA of West Virginia will operate Station N8FIP on 10, 15, 20, 40, 80 meters SSB and 20 meter packet, from 1600-0400 UTC. Weston Hospital is

Continued on page 79

Number 18 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

QRZ INDUSTRIES

QRZ Industries announces the VB-8A natural voice recorder as a fully assembled kit in a desktop enclosure with RFI/EMI protection. The VB-8A can digitize and store up to 16 dynamically-allocated messages or phrases in stand-alone mode, or 100 messages in a computer controlled "template" mode. A message can be as long as the total message allocation of 100 seconds. Completely microprocessor controlled, the VB-8A even has an auto-incrementing serial number capability (spoken in your own voice). Using a 40 kHz digitizing rate and 14 orders of audio filtering, the VB-8A provides crisp, clean audio to both a 600Ω balanced output and an 8Ω monitor output.

The introductory price of the fully assembled desktop enclosure kit, tested and burned-in, is $375, which includes a full memory configuration and an audio/PTT output cable for any standard amateur transceiver. Factory-assembled VB-8A kits have a 30-day money back guarantee and a one-year warranty. Contact *Advanced Voice Products, P.O. Box 1064, Mauldin SC 29662; (803) 676-1111.* Or Circle Reader Service No. 201.

TELEX COMMUNICATIONS

The Hy-Gain group of Telex Communications has introduced the CONTESTER boom-mike headset. It features a noise-cancelling dynamic mike that favors the voice range (100–8000 Hz) for maximum intelligibility. The mike boom rotates so it can be worn on the left or right side of the head and automatically shuts off the mike when placed upright. The headset's receivers have a 50–15,000 Hz frequency response and compatible impedance for amateur transceivers. The 5′ (1.5m) headset cord is unterminated, to accept any connector suitable for the user's transceiver.

The suggested list price is $102. Contact *Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis MN 55420; (612) 884-4051, FAX (612) 884-0043.* Or circle Reader Service No. 202.

OE2DYL

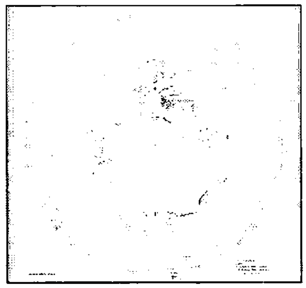
"DX Nets Around the World," List 10, is the new 1991 edition of OE2DYL's popular list containing data about more than 100 active DX nets. The price is US$4 (airmail) for this new list, or US$15 for the package of all 10 editions. OE2DYL is also offering "DX Beam Headings," with short- and long-path bearings and distances to more than 450 locations throughout the world for US$25 (airmail). No checks. To order, contact *Dieter Konrad OE2DYL, Rosengasse 1, A-5020 Salzburg, Austria.* Include an SAE.

EPO SOFTWARE

EPO Software has released a family of copyrighted logging software specifically designed for amateur radio operators. These databases have been developed, refined and improved with the input of thousands of hams worldwide. Each program can generate high-speed hard copy, video or ASCII log files, is suitable for single band or multiband use, and is user friendly and flexible. ELECTROLOG II, "The Electronic Logbook," is a sophisticated, general purpose logging and QSLing program, priced at $19.95. CONTEST LOG & DUPE SHEET ($14.95) is an easy-to-use contest log program featuring RAM-based duping, error-free default entry, and super-quick searching. DXCC AUTOLOG and WAS AUTOLOG ($14.95 each) are specialty logging programs designed for DXers and award hunters. TEN-X LOG ($14.95) is a unique data base that will sort and alphabetize by a variety of fields, including callsign or membership number.

There is a $2 shipping charge for each order. For more information, contact *EPO Software, 7805 N.E. 147th Ave., Vancouver WA 98682; (206) 892-1679.* Or circle Reader Service No. 205.

VECTOR CONTROL SYSTEMS



A Great Circle Map that shows true compass headings and distance for beam positioning is now available from Vector Control Systems. This 22″ x 24″ plastic laminated map, suitable for framing, is plotted in four colors and countries are identified by prefix. It is priced at $35 postpaid. Contact *Vector Control Systems, 1655 No. Mountain, Suite 104-45, Upland CA 91786; (714) 985-6250, FAX (714) 985-3482.* Or circle Reader Service No. 203.

MUSCLE PRODUCTS

Muscle Products has announced a new, unique demoisturant and corrosion preventative, MO-10 MOIST-OUT. This product removes water from circuits and circuit boards, preventing corrosion, and is also a light lubricant and penetrant that will reject and repel dust because of a petrochemical bonding technique that repels airborne contaminants by causing a dipole-dipole interaction, or "cation exchange," on the surface of the metal. MO-10 also removes corrosion and corrosion bridges from PC boards after a light spray and brush application, and prohibits further corrosion from taking place. Its dielectric strength is rated at 45 kV.

MO-10 is available in 16 oz. plastic pump spray bottles, 5 gallon pails, and 55 gallon drums. The suggested retail price for the 16 oz. bottle is $6.39, plus S & H. (Say that you saw it in *73* and get a 10% discount.) For more information, contact *Muscle Products, 188 Freeport Road, Butler PA 16001; (800) 227-7049, (412) 283-0567.* Or circle Reader Service No. 204.

WHATS-UP

WHATS-UP 1.00 is a software tool providing radio amateurs, or educators, with the capability to perform experiments in spacecraft orbital dynamics, as well as monitoring the environment on board several of the OSCARs during individual passes or over long periods of time. Capturing, decoding and displaying telemetry from orbiting spacecraft in real time, in the classroom, is an excellent way of introducing space science to students. WHATS-UP lets you do this using readily available low cost equipment. The documentation covers telemetry, the spacecraft themselves, receiving antennas, radio receivers, modems, and the software used to both decode and display the data in real time and to do a post-pass analysis.

WHATS-UP is available for $35 for a single copy, or $195 for a classroom license of up to 10 users. Contact *Joe Kasser, POB 3419, Silver Spring MD 20918; (301) 593-6136, data BBS (301) 593-9067, CompuServe 70531,1405.* Or circle Reader Service No. 206.

QSO SOFTWARE

QSO Software's new program, QSO Comp-Troller™, provides the ultimate companion for controlling your late model Kenwood radio. It is composed of two programs, one for the Macintosh and one for MS-DOS machines. It will manage the interface between you and any Kenwood transceiver that supports the IF-232C interface. Frequencies can be directly inputted by clicking on the VFO, Memory, or SubBand, then keying in the new frequency or modifying the existing one. Memories can be read from the transceiver and stored on disk or read from disk and transmitted to the transceiver. The program also keeps track of any adjustments made directly on the rig and reflects them on the computer display.

The suggested retail price for the QSO Comp-Troller is $99.55. For more information, contact *QSO Software, 208 Partridge Way, Kennett Sq. PA 19348; (215) 347-2109.* Or circle Reader Service number 207.

ABOVE AND BEYOND

VHF and Above Operation

C.L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake Ave.
San Diego CA 92119

Laser Communication Systems

This month I will continue detailing construction of a complete laser communications system. Last month I went over the basic power supply tor the HeNe (Helium Neon) laser that serves as system transmitter. This month we will get into the parts needed to construct a light detector coupled into a high gain audio amplifier to serve as system receiver.

The optical detector converts the laser beam into a signal coupled to the audio amplifier. A 12 volt muffin fan modulates the transmitter by passing the laser beam through the spinning blades. The fan blades, spinning at about 1 kHz, chop the beam into segments, which the receiver detects.

We can refine the audio amplifier design, but we must stop at some point for stability. Additional system gain can be obtained by optical gain, using a telescope or, in our case, a large fresnel lens which locuses energy onto the detector element, converting light to a DC current.

The Amplifier (Receiver) Circuitry

The audio amplifier circuitry is shown in Figure 1. From the gain potentiometer (10k) to audio out, it is nothing more than a basic audio amplifier. The first stage is quite special as it provides gain al 1 kHz which is centered aboul the transmitter audio frequency. This is due to the feedback network between pins 8 and 9. Initial tests showed that light sources such as argon and sodium lamps gave off a 60 Hz hum when the detector was pointed in their direction. The feedback circuit did well in limiting the hum, saving our eardrums.

The pin diode detector is the current-feed to the op amp. If all is working well, when you point the detector at a neon lamp you will hear a 60 Hz hum in your system. If your laser is operational, being chopped by the muffin fan, you will hear the 1000 hertz tone.

Don't point the laser at the detector; point it at some distant object—say, the end of your work bench, and point the detector in the same direction. As your lens and system become more sensitive. this distance can be increased.

A Few Basics

The frequency of a HeNe laser is 632.8 nanometers or 6328 angstroms. One angstrom is equal to one ten-thousandth of a micrometer. If you want to work that out to frequency, it comes to 474 THz, or 474,083 GHz if you prefer. This frequency of light is in the visible spectrum, and appears as an intensely bright red beam. Most supermarket bar code scanners use HeNe lasers, which suggests a source for surplus.

The word "laser" originated as an acronym for "Light Amplification by Stimulated Emission of Radiation." HeNe lasers are composed of a glass tube filled with a gas mixture. High voltage (around 10 kV) impressed across two electrodes is necessary for initial ignition of this gas, and 1500 to 2500 volts is necessary to maintain operation. The lasing action takes place in a fine capillary tube housed inside the main tube. The open end of the capillary tube is pointed towards the output or partially reflective mirror end of the laser.

Buying Lasers

Lasers can be purchased in two forms: plasma tubes or heads. A plasma tube is a laser with just the glass envelope. A laser head is a plasma lube mounted inside a metal tube with a high voltage cable and connector attached. Usually a ballast resistor, located inside the tube, comes as part of the "head."

You should check to determine if your head has a ballast resistor. THIS IS A VERY IMPORTANT STEP. If you try to connect a power supply and there is no ballast resistor on the head, you may damage the tube if the current flow is higher than normal.

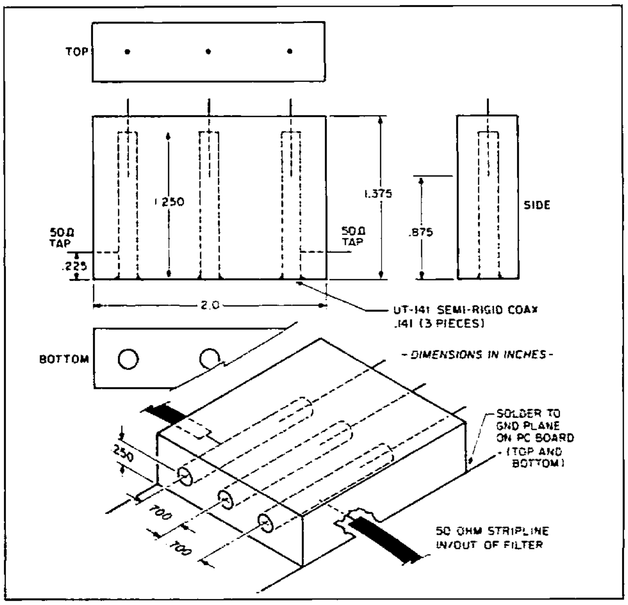


Figure 2. Filter for 1296 MHz using 0.141" rigid coax. Three dB bandwidth of 14 MHz. Ten dB bandwidth of 28 MHz. Total loss through the filter is 2 dB. (Construction details by Chip Angle N6CA.)

If in doubt about whether your head has a ballast resistor, you can add one before you do your first test. You can always remove it if it's not needed. The idea is to limit current to the tube. Insufficient current does no harm. A 10 mW laser requires about 6 to 7 mA, while a 2 to 3 mW laser needs only a few mA. My laser, obtained from a junk high speed commercial printer, has a power output of 10 mW. This makes it a class III laser, since the output is between one to several hundred mW.

BE VERY CAREFUL. Looking into any laser, particularly a class III, can cause eye damage. Believe me, this beam is extremely bright. Looking at it from the side, you may think it's not lhat bright, but trust me: It is. Also, though its spot size is small, beware of looking at its reflection. This can cause discomfort.

I found a supplier for lasers and laser power supplies that is quite reasonable: Karl Gedeon, P.O. Box 2336, Stanford CA 94309. A complete 10 mW laser head and 12 volt power supply from Karl cost only $100, and 2 to 3 mW lasers are quite a bit less. He also stocks laser related components, including laser pointers in the 2 to 3 mW range (small) and higher power pointers. I purchased a system from him and was very pleased. He also has 2 to 4 mW pointers, all operating from 12 volts DC.

In our first experiment, we used a laser transmitting over a two mile plus path with the beam so bright at the receive site that it appeared to be four city blocks on fire. There was not a city light, even at a nearby shopping center complex with all the sodium parking lights on, that could give a comparable brightness on the horizon. Only the street light nearby was comparable, but it wasn't as bright as the laser. At this two-mile distance, the 1 milliradian spot size (at the transmitter) had increased to a 5-foot wide spot.

Set-Up and Testing Details

Let's get into the details of the system that Kerry N6IZW and I put together for the test just described. The laser power supply was operated from the 110 VAC mains, so it remained at Kerry's home. Modulation of the laser was done with a 12 volt DC muffin fan. The receiver was a photo PIN detector salvaged from scrap medical equipment. The detector was tied to a current amplifier for a first stage to give low noise amplification of the signal coming from the detector. The remaining circuitry is an audio amplifier that amplifies lhe 1000 Hz modulation from the transmitter.

Many different types of lenses were employed on a hand-held optical bench to evaluate the performance of the test lens and the detector. It was found that a Radio Shack "cigarette" parabolic reflector about three inches

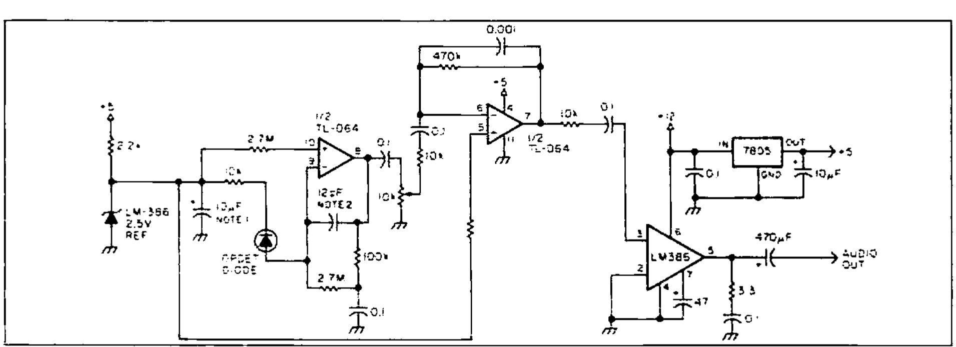


Figure 1. The Laser receive system. Note 1: The 10 µF capacitor removes the low frequency component (AC) from the optodetector. Note 2: The 12 pF capacitor on the first stage of the TL-064 prevents oscillations and improves stability. Note 3: Adjust the feedback network on the first stage of the TL-064 to maximize at your frequency (approx. 1 kHz). Response is broadband in nature.

in diameter would give a good signal, focusing the laser beam into the detector. Several other items were tried, including a magnifying mirror, and they all worked. The larger the "lens," the better the light gathering or total system gain.

Then we tried an 8" x 10" fresnel lens, not a high quality type, but rather one intended for magnifying print for reading, with a focal length of 10 to 11 inches. The best part of this lens was the cost, $1.50 at most stationery stores. It worked super.

Kerry found a plastic trash can at a local store and mounted the lens on the open end, and placed the detector on the center bottom. The lens was built out a little bit to achieve proper focus depth to the diode. In initial tests with this detector system, we were able to detect the reflection from the laser at almost anything we were able to see. The spot was reflected off of trees and wires at half a mile and more.

Improvements

This proved to be an excellent test because it was so simple and gave positive results of sensitivity and system evaluation. Several improvements were made, pushing the reflection detection range further out. The first modification pushed the range out to over 1000 feet. Street lighting created 60 Hz interference and high level annoyance in our ears. The feedback scheme to solve this, mentioned earlier, was developed by Kerry N6IZW. It worked so well I could not believe it. This mod pushed the detection range to just perceivable light reflections with the trash can and fresnel lens system.

This system was so sensitive that we could point the detector skyward and detect other interesting noises. One noise source was aircraft strobe lights. They sounded like a dull *thud, thud* at the strobe rate. When the aircraft was prop driven, and its attitude just right, we could hear the running lights being chopped by the propellers at a high audio rate. No noise came from incandescent lighting, however fluorescent, sodium, and similar type streetlights would project at the AC switching rate. This was plainly heard on the headsets. These lights could be picked up many miles away.

Even during very heavy cloud cover on a pitch black night, Kerry was able to hear the strobe of an aircraft. Pointing was not critical, as the cloud cover defused the strobe light. He could not see the light visually, which illustrates the system's sensitivity.

The PIN photodetector system is quite easy to use. With minor circuit changes, other types of detectors could be used. The trade-off is sensitivity. There are photo transistors, photoresistive cells, and photo darlingtons, as well as photo FETs. These are all sensitive, but one device that shines better than most is the *photo multiplier tube*.

The PIN diode is quite good, but the photo multiplier is superior and easier to find in surplus. One difficulty with the PMT, however, is that it requires a high voltage power supply operating at 1000 volts with 2 or 3 mA. I will get into the PMT next month and try to give you enough details to construct a very good system from the junk box.

Mailbox

Jim WA9PYH is looking for information using stripline techniques to construct a filter for use at 1553.5 MHz. He wonders what length a stripline should be to resonate at a particular frequency. Well, most stripline filters are made with 50 ohm transmission lines on 0.062 PC board, making line width about 0.100 inch (G-10 glass epoxy) and 1/4 wavelength long.

Now, the trick is that the actual length (1/4 wavelength) is modified by the velocity factor of the dielectric material, and any external or tuning capacitor. The velocity factor for G-10 PC board material runs from 0.50 to about 0.57. This factor is multiplied by the 1/4 wavelength to arrive at the actual line length. The line is or should be near resonance as it sits. Normally, 1/2 wave lines are used for filters coupling in and out with 1/4 wave sections.

Additional tuning elements shorten the line sections quite a bit, and can factor up to 0.5 to 0.6 or more, depending on type. In a filter for 1152 MHz, the line length is about 0.400 inches long. Tuning is done with a 5 pF variable capacitor to ground. So you see just how short this filter is by adding a capacitor to tune the stripline. Don't forget to couple in and out of the line at the 50 ohm point, which is 20% to 35% up the stripline from the the grounded end.

I sent Jim a few other design notes on other filters I have tried, including one that used 0.141 rigid coax to construct a very good filter for 1296 MHz. This design was first spotted in a note from Chip N6CA for 1296 MHz, several years ago. He had taken short sections of 0.141 hardline and positioned four of them in an enclosure, feeding them with stripline in and out of the filter. Tuning was accomplished by pulling the center of the coax out of the far wall of the filter through a good ground connection. This formed a capacitor with the 0.141 hardline. When the frequency was properly set, the center of the coax was soldered to the cover housing the filter. See Figure 2 for construction details.

Bill N6OLD writes about his 24 GHz operations. His recent contact might be a record; if not, it's certainly quite an accomplishment. On February 23, 1991 at 5:25 p.m., KK6T/6 (ex WB6HLC) and N6OLD made an SSB contact between Hull Mountain CM89MM (6100 feet) and Mount Diablo CM97BV (3800 feet), covering a distance of 125 miles. KK6TG's equipment was an 18-inch dish and a 14 dB noise figure pre-amplifier capable of +7 dB output power on transmit. N6OLD sported a 20-inch dish, 12 dB noise figure pre-amplifier and about +2 dB output power.

An earlier test at 2:32 p.m. between another site and Mount Diablo revealed stronger than expected signals, 40 dB out of the noise, so a longer shot was tried. The Hull Mountain shot had an even stronger signal, which suggests ducting. The low humidity (16% R. H., 50 degrees F) also helped.

Note that 24 GHz operations are right in the water absorption band, making attenuation to 24 Ghz operations higher. For least attenuation, it's best to operate when humidity levels are low. Bill is currently exploring water absorption effects and investigating propagation in this interesting (24 GHz) band.

Next month I will cover the PMT in more detail. As always, I will try to answer your questions about microwave and related topics. Please send an SASE for a prompt reply. 73s, Chuck WB6IGP

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Back to the Beginning

With appropriate ruffles and flourishes, I am pleased to note that this month begins the 15th year of "RTTY Loop"! Rather than wax nostalgic, as I often do at anniversaries, let me just say that this column has covered a lot of ground these many years, and has evolved in more ways than one.

This month, to start out, I'd like to drop back to a basic question. This was prompted by a letter from Gregory McIntire KE0UV of Belle Fourche, South Dakota, that surfaced from the stack on my desk. It's one of the "Oh, I know the answer to this" questions that soon becomes mired in too many answers.

Gregory would like to know how to determine the exact frequency that a RTTY, AMTOR, or packet station is operating on.

Exploring the Question

To quote KE0UV: "When operating CW, I think there is little question of what the operating frequency is. Whether the digital display of a transmitter is accurate or not, I think that it is understood that the frequency of operation is the actual and exact radio frequency which is radiating from the antenna. When operating SSB phone, the actual frequency radiating from the antenna varies with the modulating audio. So, we designate the 'operating frequency' as the frequency of the suppressed carrier. This 'suppressed carrier' frequency does not ever radiate from the antenna during an SSB phone transmission, though. Nevertheless, we specify the particular sideband along with the suppressed carrier frequency as the frequency of operation. But when it comes to the FSK modes, there seem to be differing opinions.

"Some rigs use two audio tones generated by a modem (TU), fed into the mike jack, in SSB mode (usually LSB) to generate FSK at radio frequency. When this method is employed, and using LSB, the two RF frequencies radiating from the antenna are the 'suppressed carrier' frequency minus the two audio frequencies. This means that the higher audio tone will create the lower RF frequency, and vice versa. If the two audio tones used are 2295 Hz and 2125 Hz, and the suppressed carrier frequency is set at 14.100 MHz (LSB), then the two RF frequencies will be 14.097705 MHz and 14.097875 MHz. If we use the LSMFT rule [Low Space Means Fine Teletype], the higher audio tone generated in the modem causes the lower RF, or space frequency, to radiate from the antenna.

"Other rigs use a direct FSK scheme which does not use SSB. The modem or terminal unit simply sends a high or low voltage to determine whether to transmit the higher or the lower radio frequency. This would be the same as two different CW signals transmitted alternately. It is my understanding that some transceivers, in FSK mode, display the lower RF at the digital readout, while others display the higher frequency as the frequency of operation.

"It has been my personal experience that many, if not most, hams determine their frequency of operation to be that which the digital readout is displaying during transmission, regardless of which of the two types of signal generation is employed. Using the 'two audio tones into LSB' (often referred to as AFSK) method, the actual frequency radiating from the antenna could be 2.295 kHz (or more) lower than what the readout is displaying. Conversely, using the so-called 'direct FSK' method, the readout should display one of the two RF frequencies correctly.

"Anyway, back to my question. What is the correct designation of a two-tone, RTTY, AMTOR, or packet operating frequency? The lower radio frequency, the higher radio frequency, the suppressed carrier frequency, or none of these?"

Gregory, I really think this is a landmark question. It has advocates on all sides. I turn it over to the readership—to all of you—for input, and look forward to forming some kind of consensus. Who knows, maybe we will even turn this into some form of necessary standard! At any rate, readers are invited to send their votes and opinions to me, at the designated address, for inclusion in a future column.

More Questions and Answers

Always looking forward to a view of another ham's messy shack, I appreciate the photo of Michael Freedman VE3BGE, hailing from Toronto, which I share with you all herewith. His station sports an impressive assortment of radio gear. Looks good, Michael, and thanks for the photo. Sure folks, go ahead and send me photos of your junk, too. You never know just what you'll find in "RTTY Loop"!

Back in February 1991, I passed along Norm WJ5Z's request for a Morse code copying program for the Color Computer. Ed Tyson N5JTY of Alamogordo, New Mexico, reached back into his memory cells for the answer. In December 1982, the late *80 Micro* published an article called "CC CQ," by Michael Chuck of Severna Park, Maryland. In this article, a transmitting and receiving Morse terminal for the CoCo is described.

The article, which also includes a complete listing for a program to accomplish the task, is far too long to reprint here. If you insist, and cannot dredge up a copy anyplace else, I can be persuaded to send you a copy, for the customary $2 and a LARGE self-addressed, stamped envelope with two ounces' worth of postage.

Last for this month, thanks to Domenic M. Mallozzi N1DM of Watertown, Massachusetts, for a comment he sent me. Dom recalls my question regarding mechanical teleprinters, and states that his station "... is a Model 15 page printer [he has both a commercial and a military version], a HAL ST5K demodulator, and a home-brew AFSK running into an old Heath HW-101 transceiver."

Dom also notes that he has "about 100 QSOs on RTTY from W1AW over the past ten years.... Don't know if the visitor's RTTY position exists in the new station, but I hope so. One of the operators there told me that very few visitors ask to operate RTTY. He said he could only remember two others in the last five years."

I'm fairly caught up with responses to your questions, and with requests for copies of the programs recently described. If you have not heard from me within a month or so of your letter, odds are that I did not receive the initial question. As always, direct your comments, questions, suggestions, and barbs to me at the above address, or via CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). I look forward to hearing from you in this, the 15th year of RTTY Loop.

Michael Freedman VE3BGE, from Toronto.

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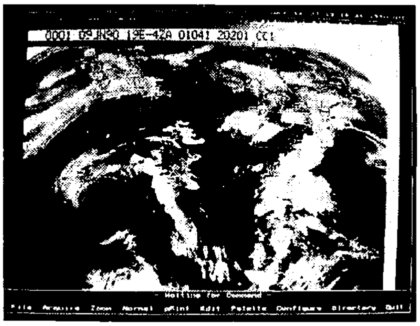

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Never Say Die

Continued from page 4

you about my getting on 75m to give some of the DXers a new one and couldn't find one single taker? The nets told me to get off the frequency because my signal wasn't strong enough to bother listening to. Okay, so I've told you about that.

One fact of life is that either you have some goals and excitement or you're going to vegetate and die. No, I'm not suggesting you get involved with DXing; we're already up to here with those ruthless fanatics. We do need a lot more DXpeditioners. We need more experimenters to pioneer new modes. We need more packet ops. But mostly, and by a wide margin, we need kids. So spend some time and go out there and poison their dirty little minds with the glories of hamming. Lie a little. Get 'em to come over to your shack.

Now wait a minute. When you get 'em into your shack I don't want to hear that you fired up and made a couple CW contacts while they got bored out of their gourds. Find something interesting for them. . . if you can. Can you show them some packet? How about a few slow-scan pictures from some weird country they've probably never even heard of?

Then tell them about the fun you've had on hidden transmitter hunts. Tell 'em about Dayton and its endless flea market. Tell 'em about Dayton and 30,000 hams, all with HTs on their belts, all squawking away at once.

Tell 'em about your local club meetings where a few old-timers do everything in their power to make it miserable for kids. No, better not tell 'em about your club meetings with endless and pointless business discussions over total trivia, followed by a lack of an interesting speaker. Maybe they'll come for the doughnuts and die of cholesterol.

A chap who runs a happiness radio program out in Michigan somehow got hold of me and got me to talk over the air about happiness. Now I may grouse in my editorials, but that's just my futile effort to whip you out of your rut and keep you alive a little longer. The fact is that I'm having a ball. You know my goals. . . like helping the music industry to grow and revamping the American educational mess so we'll have ten million excited young hams instead of a few hundred doddering old codgers whining and kvetching on our bands.

I'm having funl Every day is a challenge. I wake up around 4 or 5 a.m., shuffle into my office across the hall and start answering my mail, writing editorials for a dozen or so publications, doing business plans for new publications, and so on. Pretty soon it's 7 a.m. and time for breakfast and a check on the news. Hmmm, the news is lousy. Wars, civil and uncivil, in a couple dozen countries. . . many of which I've visited and operated from. Starving children. Refugees. Enough of that stuff. . . perhaps it's time to write King Hussein and tell him how to fix the Palestinian mess. Or give Bush some guidelines on new approaches to education. . . he sure could use 'em.

Naw, there's still a stack of mail I haven't answered. Some chap in Poland loves my music magazine and wants to be an Eastern Europe correspondent. A chap in Sabah wants to open a CD store. Another wants my opinion of his Portuguese organ music CD. Two responses to my call for ham industry people to volunteer to go to Washington with me to talk with the Commissioners and answer their questions about amateur radio.

If happiness helps keep people alive, which I think has been rather well documented, then you're going to be reading my editorials for a long time to come. I'm having a ball. My only major problem is in finding a few more competent and enthusiastic people to help me have fun. That's a downer. . . but it's compensated for by the wonderful group of people I've already got working with me. And best of all are the letters from readers. Those I love.

73 readers write to tell me they're having fun as a result of this or that article. Or that they've taken off 85 pounds, just like I did. Or that they've gotten a dozen new youngsters licensed. My *CD Review* readers write to thank me for getting them interested in some new kind of music. . . like ragtime. . . telling me how much enjoyment they're getting from reading the magazine. I love hearing from advertisers telling me how well their ads are doing for them.

I love visiting schools and teaching youngsters about amateur radio and entrepreneurialism. I love letters saying, hey you were right about packet, RTTY and so on. Retire? You're kidding! I've got too much to do. And so do you.

Those Damned Japanese?

Are you still grousing about the Japanese? About how they came along and grabbed our consumer electronics industry and parlayed it into dominating the whole financial world? About how they're buying New York and Hollywood? About how they now dominate our movie and music industries as well as every aspect of consumer electronics?

Well, I suppose some myopia helps keep us from blaming ourselves. You should see the angry letters I've gotten from automobile union members when I groused about Detroit cars recentlyl Actually, if you want to blame someone, why not pick on Ed Demming, the chap that Japan listened to and we ignored? Ed preached quality and Japan bought the idea. They imported Ed and got him to preach from one end of Japan to the other. . . and even better, they listened and did what he said.

Ed tried to sell the idea of quality here in America and was told to shut up. Alas, the concept is still alien here. I find myself driving Detroitmobiles when I rent cars on trips, so I know how they compare with my Toyota Previa. Other than being brainwashed by enormous advertising budgets and lavish rebates, I don't see why people are buying Buicks. Quality? Har de harl

Sure, my father bought Fords in the '30s and I followed suit, but when I discovered the Porsche Speedster in 1957, that was the end for Detroit. I tried a Dodge van in the '70s and had so much trouble no power on earth would ever get me near a Chrysler product again. The dealer screwed me. Chrysler could care less. My van would stall and not be restartable without pouring gas directly into the carburetor. A ham friend dug up a confidential factory notice to dealers admitting the problem and the lack of a known repair to fix it.

I find my own organization ignoring quality, despite my constant preaching and fussing. The company that handles our subscription list manages to send renewal letters in the wrong order or at the wrong time. They send renewal #4 for the first renewal effort. Subscribers tend to get furious when they get word that their subscription has already lapsed.

So what can we do? It still takes too big a computer for us to do the work ourselves. In another year I think there will be some software available that may allow us to handle our own circulation fulfillment with a super-microcomputer. I sure hope so.

The basic problem seems to be an American lack of thinking in terms of the importance of quality. We give lip service to the customer being right, but when we are dealing with a customer many of us tend to forget their perspective and just think of how much trouble this is for us.

More than one *73* editor has gotten his walking papers when I found, after many warnings, that he was still making authors wait for weeks to get a response. And I found a customer service person who had a switch installed to turn off the bell on her phone so she wouldn't be disturbed by complaints.

A good deal of this comes down to the kind of education we're providing. By the time our kids are in the work force it's too late. So we put up with toys that break, cars with doors that don't fit and engines that won't start.

To the Detroit workers who bitched to me about my love of Japanese (and German and Swedish) cars, I say take a look at the recent *Consumer Reports* issue that listed the repair records for all cars. The Detroit cars are a disgrace compared to most foreign cars.

Yes, it's difficult to adjust to the encroaching world economy. We've been so steeped in nationalism all our lives that we can't really understand about things being made where it's the cheapest to make them. Today we have products where parts are made in Singapore, parts in Japan, and assembly is in Mexico. How do we cope with that? How do we educate our children to come out on top? Blue collar jobs are going away to lower wage countries as communications and transportation costs drop. Technology is in the driver's seat, not the farmer or the factory worker. Yet we're letting our kids grow up technological illiterates. Yes, I know, we're too busy watching a ball game on TV, so we'll leave it up to our schools to teach our kids. That's not our responsibility any more.

And look at the fantastic socialist system we've built to teach our kids. We tax the heck out of ourselves and ignore that most of the money gets lost in the socialist bureaucracy and that only about 10% dribbles down to the kids. When we find it isn't working we ask for more money to feed the bureaucracy. It responds by adding more bureaucrats and 9% dribbling down to the kids. Parkinson wrote an expose of this syndrome back in the 1950s. Nothing has changed.

What's this got to do with amateur radio? Presumably you come out of the hamshack sometime and have thus, even if accidentally, procreated some kids. Well, how many of them are active amateurs? How many are gung-ho for a high-tech career? And who won the pennant in 1984?

If the schools stink, how about teaching your kids yourself? I'd love to see some articles on how to suck our kids into hamming. If you even give a hint that you care, your kids will avoid hamming like the plague, so it isn't easy. The trouble is you have to be smarter than they are. Also, they have full time to devote to frustrating you and you only have part time to con them. Any helpful hints?

If you are able to get by their guard and get 'em interested in hamming you'll have done them the best favor you could. They'll be on the road toward learning about technology and that will quickly separate them from the kids who will never even have a chance at making it beyond winning a state megabucks lottery.

If it's too late to con your own kids, perhaps you can lay some traps for your grandchildren. Or get to work in a local school and sow your seeds. You won't get much thanks and you won't get a nickel, but if there's a ledger up there, you're going to find some gold stars on it when you get your Silent Key certificate. I think there's a ledger.

So I Screwed Up... What's New?

I was just sending in a classified ad to the *Mensa Bulletin* to see if I could suck some high IQ youngsters into our hobby via *Radio Fun*. That got me to thinking... always a dangerous situation.

Five of us first members of Mensa in America got together in 1960 and formed American Mensa. I volunteered to be the secretary since I was just starting *73* and thus had a Ditto machine to print meeting notices and the addressing equipment to maintain the mailing list.

A couple years ago a reader claimed I wasn't really a founder of Mensa, but the official Mensa history printed last year finally set the record straight. I'm not sure I can claim much credit... I was in the right place at the right time... and more of a doer than the others at the meeting.

Where I screwed up, in retrospect, was in not taking the bull by the horns and running with the organization. I let my first wife convince me that I had

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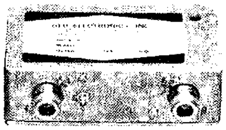

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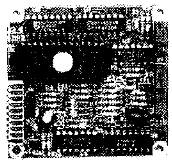

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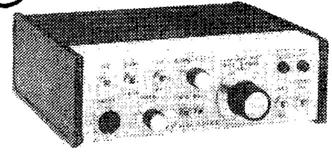

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more than enough to do starting *73*, helping to run the 1960 ARRL Convention in New York and being president of the Porsche Club. Other than damn near killing me . . . twice, I've been trying to remember what good my first wife did for me. I'll keep working on it, there must have been some good in there somewhere.

It just seems a rotten shame to have a high IQ group that has no purpose and is contributing nothing to the world. What a waste! There are chapters all around the world, but they don't even communicate with each other, so even that's a waste. Phooey.

Yes, I was up to here getting *73* started. I was raising hell with every ham author I knew to get construction articles written for the magazine. I was pestering every ham club in the country for subscriptions. I was trying to convince the over 850 ham stores we had then (before ARRL's Incentive Licensing) to sell the magazine. I also had to do all the editing, take the photographs, make all the advertising sales, proof the typesetting, do the page layouts, write and mail thousands of subscription letters, type subscription stencils, print out the subscriber wrappers, wrap 850 bundles for ham stores, bill the advertisers and ham stores, and keep the books. I was a one-man magazine publishing company with just barely enough money to print the first issue, so I had no margin for error.

As the Porsche Club president I kept the membership list, sent out meeting notices, ran the monthly meetings, laid out and ran some rallies they'll never forget, helped with timing trials and ran gymkhanas. I still have the electronic stopwatch I built for the timing trials. Oh yes, I converted a bunch of surplus radios to push-button tune the time standard broadcasts on 3.333, 5.000, 7.335 and 10.000 kHz for our rally check points.

I was also running Radio Bookshop, selling dozens of ham and electronics books by mail, plus a complete line of rally calculators, computers, watches and accessories that I advertised in the car magazines.

Then there was that ARRL Convention. I'll never forget the big banquet where a fathead future ARRL president publicly congratulated himself over the success of the convention . . . while Chet K2EAF and I sat there knowing we had done virtually all the work. We'd sold all the booths to the exhibitors, printed and sent out the posters to ham stores, written and sent out mailings to the Hudson Division members and so on. Oh well, I really shouldn't complain. I learned how to put on a convention and fathead didn't. That experience was priceless for me in 1978 when I organized and ran an enormous microcomputer show in Boston.

On the down side, if I'd gotten more embroiled in Mensa in 1961 I might not have moved to New Hampshire in 1962 . . . one of the smarter moves I've made. Too, Mensa got all messed up with some ridiculous ego clashes in the mid '60s. A few members thought Mensa was really important. Well, we have hams who think working 350 countries is important, so who are we to throw stones? I happen to think being on the DX honor roll is about like owning a Cadillac, one of America's answers to an inferiority complex. No, I've never submitted my cards for DXCC. I've never even been a fanatic about getting cards. If they come, fine. If not, so what? My fun is in talking with people and I particularly enjoy talking to unusual places. I usually call "CQDX" and let 'em call me.

I avoid pile-ups and lists most of the time . . . unless I'm DXpeditioning. Then I have my own system where I use one frequency and knock off contacts faster than any other way I've tried or heard. I work 'em right on down to the mobiles and QRP rigs without making a mess of the band. When I'm home, I prefer talking. When I'm DXpeditioning, I play the instant QSO game.

What would I have done with Mensa if I'd taken it over? Well, first of all, I'd have established some goals for it . . . a mission. Being the exclusive snob group it's become wouldn't have been on the list. When I've mentioned Mensa in my editorials before, I've always pointed out for the jealous—who reactively hate anyone smart or rich—that being smart doesn't really mean much. There's no correlation between IQ and success. It mostly means they can do well on IQ tests. Big deal.

Individual high IQ people people seem to be born with a better brain than others. Alas, that doesn't mean they know more. Indeed, think of your brain as a super computer, for that's what it is. You should know enough about computers by now to know that the hardware, no matter how wonderful, is completely useless without good software. Programming. Well, programming is what your parents, family, friends and teachers put in. But the hardware and software only provide you with an operating system; you still can't do anything with it without data. We get data through TV, books, magazines, and through everyday living. Where so many high IQ people fall short is in their early programming, their lack of data, and their having a whole bunch of bogus data screwing things up. Garbage in, garbage out, in computer terms.

Sure, we learn things. We pick up all sorts of data. But how can we know what is true and what is garbage . . . like sitcoms, soaps and sports? My solution to that is to get a high IQ group together and let the law of averages limit the worst of the bad data. This is where I think Mensa had a great potential. The very diversity of experience, data and programming would tend to cancel out much of the garbage.

So, if I'd have run Mensa I'd have organized conferences aimed to help solve government and industry problems. Even 20 high IQ people with 20 backgrounds and 20 fields of expertise would be one heck of a think-tank resource. And, unlike our commercial think tanks, it wouldn't have to make money.

What use is there of our having a bunch of smart people if we don't use them to help us solve problems? They're sure not going to go into politics . . . they're too smart for that. Heck, if we gave Mensans something creative to do we might even attract more successful high IQ people to the organization. As it is, a minuscule percentage of Mensans are outstandingly successful. Outside of Don Peterson, who was recently canned as president of Ford, I can't think of any successful members Mensa can brag about.

So I screwed up . . . too involved with temporary expediency to see the long-term picture. But, who knows, I might have succumbed to the usual Mensa hubris and rushed out to buy Bakker's Heritage Park and rename it Brainland.

You know, it doesn't take Mensan brains for a group to do a good job of tackling problems. You might want to try it with your ham club and see for yourself. Sure, you'll have some hams with strongly held opinions. That's when they've come to conclusions without positive knowledge. Some subjects are too ineffable to allow rational thought, such as religion and politics.

But it might be fun to pose some typical ham problems to the group and see how well they do in coming up with creative answers. Like what to do about the mess on 14.313 . . . or how to chill K1MAN cluttering up our bands with endless self-serving and even commercial, bulletin broadcasts. Or how your club can help get amateur radio growth going again. Or even how to get more local hams interested in your club.

Let me know how you make out. I think you'll be surprised.

Of course, instead of solving problems, you may end up with sessions like the McLaughlin Group on public television. I enjoy their opinionated approach, their grasp of complex problems, and their inability to even come close on their predictions.

Now The ULFs?

Some scientists have been having considerable success in predicting earthquakes by monitoring the ultra-low frequencies, down below one hertz. This sounds (?) like something some *73* readers might like to have a go at.

Building electromagnetic field detectors for the 0–1 hertz band certainly presents an interesting challenge. Some of the strongest signals seem to peak around 0.1 Hz. Let's see what you can come up with. Maybe we'll need a ULF column, if you start opening this band.

Dayton '91

Too bad if you missed out. The Dayton Hamvention is definitely the world's biggest ham toy store, and everything at a discount! It's two-and-a-half days long, and even so there's no way to see everything. By Saturday morning they had over 33,000 signed in. The huge Hara Arena parking lots and the fields around them as far as you could see were packed solid with cars, vans, pickups, RVs and campers, all bristling with antennas.

You see, they come in convoys from all over the country, each happily gabbing away on their own convoy channel . . . oddly like CBers. A modern version of the old Conestoga wagon trains that crossed the same plains 150 years ago. Instead of Indian arrows sticking out of the wagons, now it's antennas.

I'm not talking one or two, I'm talking mobile antenna farms that would make an AWACS plane envious. Some of them had to have had serious problems with overpasses. These convoys must have wiped out TV reception for whole towns as they passed through.

Imagine, if you will, 35,000 hams, all with at least one HT on their belt, all with their squelch breaking every few seconds. Many had two, three or even four HTs, one for each band so they wouldn't miss out on any bargains their convoy pals might find.

"Hey, here's a guy selling fax machines for $300! Brand new!" "Wait'll you see the Mac software I've found over here." Hams were excitedly carting boxes back to their cars all weekend. With 530 booths inside the arena and 2,276 flea market spaces, now how can anyone do a decent job of checking all that in the only 1,260 minutes the Hamvention is open? Well, 35,000 hams sure tried!

If you try to see 'em all, that means you've got to manage an average of 27 seconds per booth or flea market area . . . and that doesn't count any time waiting on the chow or portapotty lines. That doesn't even allow for any time spent attending any of the 55 forums . . . and they're one of the main reasons many drive or fly all that way.

They had forums for packet, AMSAT, county hunters, antennas, home-brewing, contests, Collins users, ARES, weather satellites, MARS, VHF, repeater coordination, OSSBN, 10/10, FCC, SSTV, Firebirds, SPAM, DX, Red Cross, ATV, bicycle hams, QRP, ARRL, scanners, and SWLs. There were forums on getting new hams, on recruiting kids, and many more technical forums.

Even K1MAN, obviously not totally satisfied with broadcasting on all bands day and night with his endless "bulletins," had a 90-minute forum. Oh darn, I forgot to go to that one!

Yes, there was an Uncle Wayne forum where I tried to keep a packed room awake and chuckling at our collective misfortunes. Alas, as usual it was like a sauna.

The most exciting part of the Hamvention for me is seeing the new equipment being exhibited. Much of the new gear is so complex that it takes an expert several minutes just to cover the basics. It made me wish there was some way to get across all this information in a product review. But there's so much to tell that we're talking about book-length reviews. You really have to see a lot of this stuff yourself and talk with the people who have designed it.

While another ham rag devotes its editorials to complaints about hamfest food, I still look forward to the Hamven-

tion BBO sandwich. Love it! The Hamvention committee sure is cheap with their refreshments for the exhibitors. There's some coffee and a supply of doughnuts which runs out in minutes. That's it. No cold drinks. No sandwiches. They are considerate in providing a special room where exhibitors can buy lunch instead of waiting on incredibly long lines. But they don't reckon with us notoriously tight Yankees. So I grumblingly shell out and buy a BBQ sandwich which I split with Sherry. Okay, I'm cheap . . would you rather I increased the *73* cover price and went first class? Please advise.

The *73* Booth

We had the premiere issue of *Radio Fun* available and got completely cleaned out of the over 3,000 copies we brought. We announced this new publication aimed at newcomers to the hobby in the April *73* and have been getting an average of 100 subscriptions a day ever since. We had 'em lined up at the booth to subscribe.

We had another line of customers signing up for *73* subscriptions. Many were furious at *CQ* for putting *Ham Radio* out of business and then, despite promises to change, continuing as a contest magazine. We sold more *73* subs this year than we've ever sold in the 30 years I've been exhibiting.

I was delighted, too, by the parade of well-wishers who said they enjoy my editorials and agree with them. That's a change from the past, where many claimed they enjoyed 'em, but didn't always agree with me. And I don't think *I've* changed!

A gratifying number of readers stopped to thank me for getting them to (a) stop smoking, (b) take off weight, and (c) go into business and have fun making money.

The *73* crew was even more excited to hear from one advertiser after another about how happy they are with the sales their ads are providing. I'm used to hearing that we outsell *CQ*, but it's been a while since we've outsold *QST* consistently. We've got to watch out or *73* might start getting fat again, like it was a few years ago.

We did make sure that potential *Radio Fun* advertisers got a sample copy of the premiere issue. Many said they wished they'd been in it and wanted to be sure not to miss out when we go monthly starting in September. Since newcomers are responsible for a high percentage of ham sales, this makes sense.

The Ham of the Year!

Johnny Johnston W3BE, our liaison at the FCC, was awarded the coveted Hamvention award this year. An excellent choice. Johnny had some good news for us . . and some bad. On the bright side of the ledger was the success of the no-code license. This has definitely increased our input of new hams. Indeed, many stopped by the *73* booth to thank me for pushing for the no-code license for the last 32 years.

Continued on page 73

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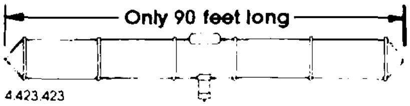

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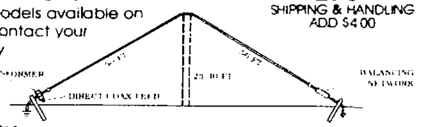

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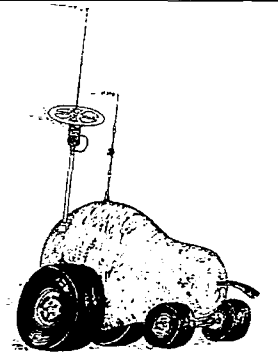

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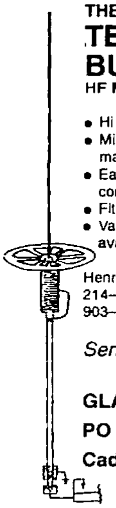

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CIRCLE 124 ON READER SERVICE CARD

Continued from page 71

Talk about "never say die"! They also subscribed to *Radio Fun*.

The idea of *Radio Fun*, in case you've just emerged from hibernation, is to make sure that as high a percentage as possible of new licensees actually get on the air and start having fun. It'll be explaining how to get involved with packet, satellites, DXing, contests, certificate hunting, UHF, repeaters, transmitter hunting, ATV and so on. It'll also be running technical articles aimed at helping newcomers understand what this radio stuff is all about. And it'll be reviewing every kit we can get our hands on. Carole Perry WB2MGP has a column for the newcomer. Gordon West WB6NOA shows you how to upgrade.

We also brought along a big stack of the CDs my three record companies have been producing. . . and sold right out. I was pleased to find so many *CD Review* readers stopping by to say hello and keep up the good work. We will.

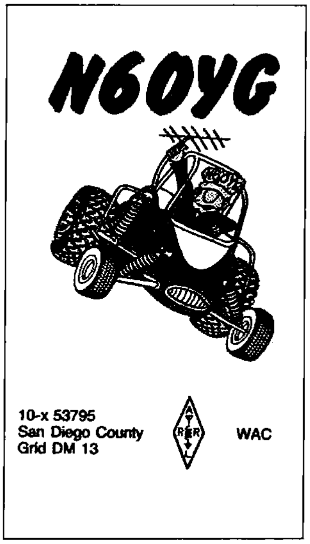
The excitement over the new nocoders was mitigated by Johnny Johnston's mentioning that around 20,000 amateurs have historically been lost each year through winning their Silent Key Award or lack of interest. The 10-year licenses have obscured this loss, giving the deceptive appearance that we've been gaining in numbers. Indeed, at that rate our supposed 500,000 total licensees could eventually be as much as 200,000 overstated. This is what W5YI has been telling us in his newsletter. . . and what the ARRL has been determined to ignore with their inflated numbers. The sorry fact seems to be that even with the new no-code licensing spree, we're only growing at about 1.2% per year. . . one-tenth the growth we averaged in the 1945–1964 era. . . before Incentive Licensing hit.

I was heartened by a parade of readers stopping by the booth to tell me about their successes in getting youngsters into the hobby. I said the same thing to all of them. . . send me some pictures. Prove it. I saw a few more youngsters at the Hamvention this year than previously, but they were still a rare sight. . . nothing like 30 years ago, when kids were all over the place.

You know, I hear all this baloney about how many hams are interested in the code, yet even at the largest hamfest in the world (outside of Japan), there wasn't a code speed contest. They used to be a big feature at virtually every hamfest. I'll tell you what, I'll have *73* print some certificates if your club will put on contests at your hamfests. Let's start making it a matter of pride to be good at copying code. You'll probably want certificates for 20, 30, 40, 50 and 60 wpm. Think that'll hold you?

You say you want practice tapes? Give me a break! Get a computer and do it that way and get off my back.

During my talk, I did mention how easy it is to learn the code at any speed you want. The ensuing rush wiped us out of our 20 wpm tapes at the booth. We also sold out of our $99 videos on how to generate an extra million in sales with PR. We're still getting raves on that. It's even being used by some M.B.A. schools.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

It was fun, too, meeting so many old friends. Walt WA6BMG, who I used to talk with in 1938 in Brooklyn, where he was W2LBF, was there. Arne SM5AM, who showed me around Stockholm and Aland (OHØ) back in 1966, was there and looking healthy. Norm W2JUP, who took over the RTTY column in *CQ* when I became the editor, was helping AEA show their new stuff. I've been promised an article on their new gear, which is amazing. Friends from South Africa, Kenya, and all over Europe were there and said hello. Jack Aviv WA2KNC, my first *73* employee (1961), was there.

Maybe you'll want to think about joining one of the convoys heading to Dayton next year.

Radio Fun

The subscriptions to *Radio Fun* have been pouring in. That's pretty good considering that it was just announced.

The concept has caught on. The idea of stressing the fun of amateur radio as a follow-on for the new no-code license is timely. We do have a fantastic hobby, one that can be enormous fun. Often we get all involved in some kind of aggravation and forget that fun is what amateur radio is all about. . . the passion which makes it so exciting.

No one is paying us to do this. We're not only spending great gobs of our time on our hobby, but we're spending our own money for the equipment. We provide public service only partly in repayment for the incredibly valuable frequencies we get to use. Mostly we do public service because we enjoy it. It gives us a sense of having done something positive. It gives us a sense of our own value and importance. It gives us an opportunity to do something worthwhile for the common good. It helps give us a feeling that we've contributed to the world. . . and that feels good. . . it's fun.

Somehow, the harder we work at something personal like this, the more fun we have. I treasure the hundreds of times I stayed up most of the night building equipment. But not only did I have a ball doing it, I also laid the foundation for a lifetime of ham publishing.

In 1946 I built one of the first FM modulators into my Meissner Signal Shifter and helped W2GDG pioneer narrowband FM. And I loved every minute of it.

I built all kinds of elaborate RTTY equipment and had so much fun that I had no choice but to start a magazine on the subject to try and inveigle others into sharing the fun I was having. I love to share my enjoyment with others. That's one of the reasons I have so much fun with *CD Review*, my music magazine. I'm getting tens of thousands of people introduced to classical music, to ragtime, and other kinds of music they might otherwise miss.

Okay, goody-goody for me, but how about you? What's the most fun you've had in amateur radio? And why don't you sit down and write about it so we can pass along your story to the *Radio Fun* readers? Have you mixed hamming with sports car rallies? With hot air ballooning? With travel? Why the heck not? I don't see any anchor tied to your ankle. I've done all those things and I can promise you you'll never forget the fun you'll have.

How about building ham gear and test equipment from kits? I've built so many Heathkits I've stopped counting. Old-timers will remember Eico kits. Our Incentive Licensing disaster killed Eico. There are plenty of kits around today that are fun to build. . . and more are coming. With the enthusiasm we can build via *Radio Fun* I'll bet we can get hundreds more parts kits on the market. If you've built a kit you think others would enjoy, let's hear from you! Share your fun the way I do.

How about some ideas on hidden transmitter hunts? Our young newcomers will have a great time if we can get them involved with those. It won't be a bad idea to shake some of the rust off old-timers too. Some of you old coots are about as active as the Tin Man after a rainstorm.

Say, coots, when you find a youngster who is a likely ham prospect, you could spring the $10 for a subscription to *Radio Fun*, right? It's bad enough being an old curmudgeon without being a cheap old curmudgeon to boot.

The Premiere Issue

The first issue of *Radio Fun* is out. We somehow managed to get it out in time for Dayton. I was very impressed with the advertising support we got, sight unseen. I expect you to subscribe and buy at least one piece of gear from each advertiser. Fair is fair, right? That's the least you can do.

We'll be starting the regular monthly publication in September. That'll give you some time to send in articles aimed at making amateur radio more fun—particularly for newcomers. It'll give the ham industry some time to get horsed around to advertising so we can have a big fat publication, packed with kit reviews, simple electronic and radio theory to help you understand what's in those black boxes you've been talking into. You do want to understand how electrons work, don't you?

I expect we'll be seeing some of Editor Bill WB8ELK Brown's fascinating stuff. He came into the office today with a tiny TV transmitter. The darned thing, sent in by KC6CCC, was about 1.5" square and had an exciter on 434 MHz, plus a 100 milliwatt amplifier and modulator, all run by a tiny 9V flashlight battery. He'll no doubt be sending it up with a miniature camera in one of his balloons. Ever tried that? The balloons can get up to 100,000 feet and be copied up to 400 miles away! You just put your TV antenna on your cable converter and tune to channel 60. Voila!

Only $10? How Is That Possible These Days?

Radio Fun is a no-frills publication. We're doing it in a tabloid format, like your local shopper. We want to get information out to help newcomers. . . to make hamming more fun for everyone. This is a labor of love by the *73* staff. We haven't added any extra people. As soon as you add staff and use slick paper, the cost skyrockets and then we have to charge $20 a year just to break even. We'll keep *Radio Fun* at $10 as long as we can, but if it gets too fat we'll have to add some editors and up the subscription price.

Remember too, your $10 is subsidizing 20,000 copies of *Radio Fun* which are going to newcomers to help them get started in our hobby. This is our opportunity to start them off right and help them avoid some of the miseries we went through at first. It's difficult for old-timers to remember how dumb they were at first. . . and how much they needed help.

I think *Radio Fun* may get old-timers to think in terms of elmering youngsters and perhaps even getting down on the Novice bands to lend a hand. . . after turning off their linears. We'll see.

Meanwhile we need all the support we can get. . . in the way of subscriptions, advertising, and enthusiastic articles on exciting ham activities and kit evaluations. 73

Subscribe to *73 Amateur Radio Today*

1-800-722-7790

73 INTERNATIONAL

Arnie Johnson N1BAC
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N. Swanzey NH 03431

Notes from FN42

Of much interest in this month's column is an informative report from Tim Chen BV2A of Taiwan. In conjunction with that, I am including portions of a recent article from The Wall Street Journal, *reporting that Taiwan has ended its civil war with mainland China and recognizes the Beijing leadership.*

"OSL to Box 88, Moscow." How many of you have ever wondered what Box 88 is really like? Now you will find out, thanks to Ron Gang 4X1MK.

Onward to the good news!—Arnie, N1BAC.

ROUNDUP

Switzerland From a message by the ITU Secretary-General, Pekka Tarjanne, about the 1991 World Telecommunication Day which occurred on May 17, 1991:

This year, the theme of World Communication Day is a subject close to the hearts of every one of us: Ensuring the safety of human life. Due to the contributions in this area made by telecommunications, the latter was celebrated as part of the Natural Disaster Prevention Decade proclaimed by the United Nations General Assembly.

The first commercial radio telegraph services were introduced at the end of the 19th century. This new communications medium was a godsend to mariners in distress. Yet, if lives were to be saved, the message had to be heard. For this reason, an international agreement, signed in Berlin in 1906, specified that "Wireless telegraph stations must give absolute priority to receiving and replying to distress signals from ships and take all appropriate action." This same agreement included the international adoption of the SOS signal. The International Telecommunication Union introduced other safety measures: Ships should have a radio set on board and special radio frequencies were reserved for distress signals.

Over the coming decade, the Global Maritime Distress and Safety System will be brought into use. This new system, developed by the International Maritime Organization in collaboration with the ITU and other bodies, will provide a new degree of safety to seafarers.

Transportable satellite earth stations can be used for emergency communications and, coupled with land-based facilities, provide a vital tool for relief operations. However, much remains to be done to ensure the fast transborder movement of such telecommunications equipment to disaster sites. With this in mind, the ITU, working with other concerned organizations, has proposed a project to facilitate the speedy movement and customs clearance of telecommunications equipment for disaster use, which could, in due course, lead to an international convention. Also, cellular technology can prove to be a solution to the difficult problem of providing telecommunications outside major urban areas.

It is, indeed, my ambition to speed up the arrival of relief to anyone in danger, wherever disasters may strike or, more generally, in need of assistance in rural and remote areas.

ISRAEL

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Kibbutz Urim
D.N. Hanagev 85530
Israel
PACKET: 4X1MK@4Z4SV.ISR.EU

We were greatly relieved with the cessation of the hostilities in the Gulf. It spelled for us here in 4X-land the end of destruction and injury caused, not to mention the disruption of normal life for the month and a half of Operation Desert Storm. The Civil Defense Authorities gave the O.K. to put the gas masks away and open up the rooms (and some hamshacks as well!) that each household had hermetically sealed. Nightlife in the big cities has commenced once again.

The Ministry of Communications issued a special letter of thanks to the Israel Amateur Radio Club in recognition of the public service provided by the amateur community during the crises. Hopefully now diplomacy will take precedence, and we will be able to see the end of the lack of peace accords in the region. The time is ripe, and judging by the trends in the world, that we have noted in this column over the past years, it appears that we are nearing a new age where enlightenment will banish the darkness. Let us all do our part in our own small way, and see to it that our international contacts via ham radio will contribute to the good will!

A Visit to Box 88, Moscow. Early last March, Dr. Oded Schremer 4X4SO was invited to the Soviet Union for a scientific conference. Before leaving for Moscow, Oded got on the air and contacted a few Russian hams, who invited him to visit the Central Radio Club. Upon arriving, Oded saw that his schedule gave him the mornings off. One morning, after calling a number given him for the club, he set off for a visit, accompanied by his interpreter. The club was located an hour and a half from the center of Moscow.

The State-run and supported Central Radio Club is housed in a two-story building somewhat resembling a school. A few rooms house the world famous P.O. Box 88 Moscow QSL bureau, whose six full-time employees sort many, many millions of QSL cards each year! Another room holds a large ham station which normally has a full-time operator who, unfortunately, wasn't there that day.

There is yet another section, full of test equipment and staff to help out those building or repairing their own gear. It should be pointed out that due to economics, imported commercial gear is not available in the USSR, thus almost all stations are homemade.

On the first floor there is an exhibition of all kinds of radio equipment, and the halls of the building are decorated with color posters of sports people and radio amateurs. All in all, the Central Radio Club of Moscow is a building buzzing with activity from early in the morning to late at night.

Nocolai UA3AF, who heads up the operation, showed Oded a beautiful full-color magazine that they put out. Oded told them that he was really thrilled to be inside "Box 88 Moscow," that address being world famous, known to virtually every radio amateur on the globe. This really made the people on hand very proud, as it turns out that they are seldom ever visited by hams from outside of the USSR, and had no idea of their image abroad.

Photo A. Oded Schremer 4X4SO with QSL sorters at "Box 88 Moscow"—the Central Radio Club.

Indeed, the hams at the Central Radio Club had never met anyone from Israel before, and 4X4SO's visit was a big event! Until April 1988 (just 3 short years ago) hams in the Soviet Union were prohibited to contact Israel. They told Oded that this ban had caused them much grief, as they had heard us on the air, and had always wanted to make contact. Life in the USSR has changed since then, with new openness and freedom of expression. Oded parted with his hosts at Box 88 after taking photographs as a souvenir of this historic meeting, having been most warmly received.

Looking out of the car window, as any keen-eyed ham should, Oded spotted a number of beams and quads on the rooftops, but unfortunately did not have the time to visit any hams in their homes. Now, for 4X4SO, Post Office Box 88 Moscow means much more that just an address for QSLs. Hams visiting Moscow would do well if they paid a visit to the Central Radio Club there.

NEW ZEALAND

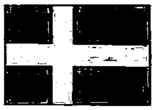
Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Hello to all! Just a quick note to advise you that the NZART Hastings Branch, ZL2BEI, is organizing another 160m event to encourage hams to "Have a Go" on 160 meters, and maybe meet new fellow hams who are 160 enthusiasts.

The frequency is 1850 kHz, ±10 kHz, LSB or CW, 0800 to 1200 UTC, 21–22 June 1991. There will be as many ZL stations available as possible.

You may remember that the Hastings Branch ran one of these events last year in October. It generated so much interest that this one has been put together, and we hope that this news reaches you in time to participate.

If the interest continues, the Hastings Branch of the NZART will organize another weekend event for next March in 1992. 73, Des ZL2VR.



SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S-155 00 Nykvarn
Sweden

The European CEPT License

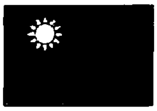
Some years ago, 26 European Telecommunication Authorities agreed upon simplifying the procedures for radio amateur operators to use their ham equipment while visiting CEPT member countries. The result is that no visi-

tor license has to be applied for. You only bring your home country license that states which class of CEPT license you have. There are two classes, Class 1 with both HF and VHF privileges, and Class 2 for VHF (no code required). Last year five East European countries indicated that they will apply for membership in the CEPT community.

So far, 17 CEPT countries have implemented the recommendation for the so-called CEPT license, recommendation T/R 61-01. These countries are: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Liechtenstein, Luxembourg, Monaco, The Netherlands, Norway, Spain, Sweden, Switzerland, and the United Kingdom.

The identification for using the CEPT license is somewhat cumbersome. Visiting Sweden, a CEPT ham MUST identify as follows: SM/home call/P for portable or /M for mobile. Either /P or /M MUST ALWAYS follow the call. In most countries, it is not necessary to include the number for the call area.

Hams from other countries must, however, apply for a regular visitor license. In the past, Sweden has required a written statement by the local police of the applicant's "good conduct" to be included with the application for a visitor's license. This requirement was deleted on January 1, 1991.



TAIWAN
REPUBLIC OF CHINA

Tim Chen BV2A
PO Box 30-547
Taipei
Republic of China

Although I have not reported in this column for a considerable length of time, I believe that our recent developments in Taiwan may be of much interest.

We have made great strides in amateur radio activities. Local government has given the public the qualification examinations three times: in 1984, 1988, and 1990. As of this date there are more than 300 licensed stations and about 620 ham operators scattered on this island. The majority of the stations are in the second district, BV2, which belongs to Taipei City and Taipei County, with BV4 and BV7 next, and only a few stations located in other districts—BV1, BV3, BV5, BV6, and BV8. BV9 is for offshore islands, and BVØ is reserved for special occasions and DXpeditions. The indications are that the number of amateur radio candidates is increasing rapidly. The best guess is that 2,000 people will participate in the next examination, which hopefully will take place in June 1991.

It will be quite a burden to the authorities to handle this sudden surge in the ham population. They will probably have to revise the rules and administrative matters, as well as develop an examination pool.

Presently there are a great number of young men and women (CBers) who are enthusiastically, though illegally, using V/UHF operations each day on 144 and 430 MHz. The chaos on the air is terrible. How to lead them a dance [control the situation] is a government problem all hams are concerned about.

In spite of the adverse circumstances, hams had an experimental test with Japan last July with VHF and UHF QSOs at three different positions on mountains at 600, 2,000, and 3,200 feet above sea level. The CBers were well-convinced of amateur radio communications being worthwhile. We hope that more and more CBers will change their status and become good hams.

The booming situation makes it necessary for us to set up an independent society strictly of, by, and for the radio amateurs. It will not only assist local hams to further progress, but also foster the good relationship with all the amateur fraternities in the world. We assure that the increase of BV stations will be easy to access on the air in the future. The general assembly of the independent society, temporarily named the Chinese Taipei Amateur Radio League, was scheduled to have its inaugural ceremony on March 10, 1991. Very soon it will apply for membership in the International Amateur Radio Union (IARU).

At this moment there is no change in the regulation that we do not grant licenses to individual visitors. A DXpedition group is usually welcomed and given a special callsign, but the group has to submit an application at least two months in advance for approval. The Post and Telecommunications Department, M.O.C. No. 2 Chang Sha Street, Taipei, Taiwan, ROC is the authority. And if we can be of any service to you, please contact the Chinese Taipei Amateur Radio League (CTARL) at 3F, No. 19, Lane 312, Pa Te Road, 2nd Section, Taipei, R.O.C., or P.O. Box 93, Taipei, Tel. (02) 711-4652, FAX (02) 771-2378. 73, Tim Chen BV2A.

From *The Wall Street Journal*, dateline Taipei, May 1, 1991: After more than 60 years, China's civil war has officially ended, at least in Taiwan's eyes. Taiwan President Lee Teng-hui declared the termination of a period of emergency rule imposed just before the communists took control of China in the late 1940s. The emergency froze in place a state of war with the communists that, despite some periods of cooperation, extended back to the late 1920s. Until now, the Kuomintang government in Taipei officially viewed the Beijing government as rebels who had usurped the KMT's rightful authority to rule mainland China.

President Lee's proclamation, which came as a quasi-official Taiwan delegation visited Beijing for the first wide-ranging talks ever held with mainland officials, represents another important step in the gradual relaxation of tensions across the Taiwan straits.

Hamsats

Continued from page 54

The Soviet Connection

A verified two-way exchange of callsigns was made between Ken KB5AWP and Musa Manarov U2MIR. While mobile-to-mobile contacts are common, space-mobile to space-mobile ham contacts have only begun recently. Ken on *Atlantis* and Musa on *Mir*, the Soviet space station, were the first. The low orbits of the two vehicles make *Mir*/shuttle line-of-sight possibilities uncommon, but for this mission it worked. This time voice was used, but packet could be tried on another flight.

Educational Activities

One of the most successful aspects of SAREX on STS-37 was the communications with educational institutions. The astronauts answered questions from children in many schools. Often the shuttle was not over an area at the correct time for school hours. This necessitated the use of phone links and bridges to hams with direct access to the shuttle at specific times.

In Australia, Graham Ratcliff VK5AGR provided links while Junior de Castro PY2BJO took over from Brazil. The links and phone bridges worked for STS-35, and did the job again for STS-37.

The school connections during April 6 included 10 educational groups from Texas, Ohio, Illinois, California, Pennsylvania, and Oklahoma. Many others listened to the two-way conversations through the link system created by the SAREX supporters. SAREX brought the space program into many classrooms in several countries during the flight.

SAREX In the Future

Enormous effort has been required to make SAREX a reality. Hundreds of hams have been involved with parts of the program. Organizers and promoters like Bill Tynan W3XO and Roy Neal K6DUE have put in long hours to find the support needed to make SAREX happen. Roy has announced that new video tapes documenting the program will be available when school starts this fall. Lou McFadin W5DID is perhaps the key ham responsible for flight gear. Several hundred documents and drawings have been required by NASA before allowing the ham equipment in the shuttle. Lou and his group fulfilled the requirements.

It is hoped that all the effort to operate SAREX on four flights will now begin to pay off. Rather than being classed as an additional experiment each time, SAREX gear could be available for use by any ham/astronaut requesting the system for a specific mission.

The next opportunity for SAREX may be later this year or early in 1992. One astronaut has expressed an interest, and others may be joining the ranks of amateur radio very soon. An intensive weekend ham radio course is in the planning stage for a group of current and future astronauts. While STS-35 stressed packet communications and STS-37 promoted educational efforts, a more "standard" ham-QSO activity is expected for the next chance. An all-ham crew may be a first this time, but it may be quite common in a few years.

Number 24 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525-4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Thank you for your cooperation.

I would like to hear from hams that operated club station KJ6DO on Johnson Island. History, information, QSL card, or pictures would greatly be appreciated. *Chuck Bowers KJ6DO, 837 Ridgeview Ct., Oakdale CA 95361.*

WANTED: Compact disk to learn and improve speed of CW. *Doug Franklin VE3EYE, #77 Glasgow St., Conestogo, Ontario, Canada NØB 1NØ.*

I urgently need schematics and manual for a Santec ST-142 handie-talkie, to repair mine by the time my license arrives. Will pay for copies. Thanks. *Jeno F. Racz, 850 September Drive, Cupertino CA 95014.*

I am looking for software and connection into (such as Galfo) to operate an Apple IIc with an MFJ-1224 CW/RTTY interface. *Bruce Danielson WA1WOG, 4 King James Drive, East Lyme CT 06333.*

I need a copy of the schematics or booklets on the SBE 33, the Hallicrafters SX-101, and HT-34. If you know of any upgrades or improvements to these items, I would appreciate it. *Paul Christie ex-K2UKT, 208-27-15th Rd., Bayside NY 11360.*

I need a schematic for a METSAT, model 1500 computer-based weather satellite video scan converter, and connections to Tandy CoCo 64. Will pay for copying and mailing. *William A. Rizzo, P.O. Box 578, Pago Pago, Am. Samoa 96799.*

I am fourteen-years-old, and have just started working towards my Novice ticket. I would like to thank all the staff at *73* for the great articles that gave me the inspiration to get my license.

I have a problem with getting radio equipment, though, and would like to ask all the hams out there if they have any extra stuff just collecting dust that could get me started towards my Extra license. I would also like to ask any ham in the Modesto, California, area if they have any interest in helping me get my Novice license. I'm having trouble with the code. *Brandon Wilson, 920 Briggs Ave., Modesto CA 95351.*

Need instruction manual or copy for Drake MN-2000 antenna tuner. Need overall chassis schematic and service manual for Tempo/Uniden 2020 transceiver. Willing to pay copy and postage costs. *Evan Rolek K9SQG, 2053 Mohave Dr., Dayton OH 45431. (513) 426-1986.*

Number 25 on your Feedback card

HAMS WITH CLASS

Carole Perry WB2MGP
P O. Box 131646
Staten Island NY 10313-0006

An Uplifting Experience

"Now, class, for today's lesson we're going to discuss how to QSL to our terrestrial QSO with the astroham, and plan our unit on SAREX and the STS-37 mission in reference to the deployment of the Gamma Ray Observatory." Who would ever have believed a few years ago that this could ever be an authentic opening statement for a teacher to make to a 6th grade class, or that the youngsters would understand and respond eagerly to it?

Of all the exciting adventures that teaching amateur radio in a classroom has led me to, none excites me as much as our involvement with the space program. The remarkable thing about this topic is that it is so dynamic. Intrinsic in the material are new and creative ways to introduce space studies to children.

Therefore, I jumped at the chance to accept an invitation by the Johnson Space Center Amateur Radio Club to participate at the SAREX Booth of the National High School Science Teachers Convention in Houston, Texas, this past March. I knew that I'd enjoy talking about amateur radio in the classroom at the convention, I just had no idea how momentous a trip this would turn out to be.

Rosalie White WA1STO, head of the ARRL Education Department, and I had a wonderful time at the booth with our hosts John WD5EEV and Karen Nickel WD5EEU, Dale Martin KG5U, and Ruth Ann Barret KB5MOT. Hundreds of science teachers stopped by the booth to learn more about SAREX (Shuttle Amateur Radio EXperiment) and how it can be used to motivate youngsters in a classroom.

During my visit to the Johnson Space Center, I was privileged to address the amateur radio club there and share some of my classroom experiences with them.

The highlight of the whole week came when John took us to the WETF (Weightless Environment Training Facility) at the space center to meet with mission specialist Jay Apt N5QWL. Jay had made a contact with my kids on the CQ All Schools Net last October, so you might think I wouldn't be unduly overwhelmed at the prospect of meeting with him in person. You'd be wrong. I was absolutely awestruck by what I got to see and do that morning. Jay was warm and gracious and even invited me onto the diving platform for a picture to show the children. He'll never know what an impact those photos had in my school. Children with all different backgrounds and abilities were enchanted with the album I put on display. They identified with my experiences, and related to the feeling of pride for the astronauts' work, that I conveyed to them.

As I watched Jay being submerged into the pool to practice new spacewalk equipment and techniques, I thought about what phenomenal courage and dedication it takes to be an astronaut. Too many of us have become jaded about space shuttle travel, and we tend to take for granted the very special people who help make it seem easy.

At this point, pilot Ken Cameron KB5AWP joined us at the WETF. He too was gracious enough to spend time and respond to questions that I knew the children would love to have me ask. He gave me an autographed photo of the STS-37 crew which is presently displayed in the showcase of our school's lobby.

The upcoming launch of the *Atlantis* on April 5 was starting to take on a very personal meaning to me. Personal contact with these extraordinary people either in person or on a radio has to heighten interest even in the most blasé of children. That's why one of the goals of SAREX is to encourage public participation in the space program; another is to support educational opportunities offered by amateur radio voice and digital communications.

Photo B. Astronaut Jay Apt N5QWL welcomes Carole Perry WB2MGP on board the diving platform at the WETF

Photo C. Carole with Atlantis *pilot Ken Cameron KB5AWP.*

Photo D. A view from the press site of the Kennedy Space Center. Notice the countdown clock.

Photo A. Carole Perry WB2MGP and John Nickel WD5EEV have fun working W5RRR at the Johnson Space Center.

Because all five of the astronauts on STS-37 are hams, and because of my meeting two of them in person, I decided to accept an invitation by *73 Magazine* to see the launch of the *Atlantis* at the Kennedy Space Center in Florida.

I took the opportunity to attend various press briefings before the launch. Reporters were given the chance to ask in-depth questions of experts involved with the development of the Gamma Ray Observatory from TRW, and to attend conferences about SAREX, biomedical research, and structural information relating to the mission.

Lift-Off!

There aren't many events I consider worth getting up at 4 a.m. to attend, but the lift-off of the *Atlantis* surpassed my wildest expectations. Dawn broke as I

approached the Kennedy Space Center that morning—along with a downpour of rain. There was cloud cover all morning, and it was touch and go up until the planned pause with nine minutes left in the countdown. Launch officials switched runway-approach directions for *Atlantis* in the event it had to make an emergency landing at Kennedy Space Center. The shuttle's three main engines and two booster rockets ignited at 9:22 a.m.—four minutes behind schedule. With a fiery leap off launch pad 39B, *Atlantis* zoomed through the low cloud cover and soared eastward over the Atlantic Ocean.

Mesmerized, I watched this phenomenal event from the base of the countdown clock at the press site. When I heard the announcement, "We have lift-off of the *Atlantis*," I felt an unparalled surge of pride. As the *Atlantis* disappeared into the clouds, I turned around to see that same "special look" on the faces of the other reporters. Some were teary-eyed, some were applauding and cheering, but everyone was smiling.

In the quiet moments of walking back to my car in the parking lot, I tried to sort out the euphoric feelings and the incredible myriad of stimuli of the last week. The only thing I could think of as I drove out of the space center was that this was one spring break when the *teacher* would have the best "Show and Tell" of anyone in the class. 73

Space Travel and Communications

The National Air and Space Museum, in collaboration with NASA, has prepared a wonderful book for teachers, called *Discovery*. The following are some ideas for classroom activities, all of which can be adapted to suit your age and ability group.

1. Have students interview an older adult, such as a grandparent, and ask about Neil Armstrong's first steps on the moon on July 20, 1969. Students might ask the adult: "Where were you?" "How did you feel?" Have students tape their interview so it can be shared with the class.

2. Discuss why some astronauts need to wear spacesuits. Have one student trace around another student's body while he or she lies flat on a large piece of paper. Have students design a spacesuit on the tracing, labeling all the different parts of the suit. Remind students not to forget any important items. Then have them color the suit and add their nametags.

3. The *Saturn V* rocket was used to launch the *Apollo* spacecraft. As an art lesson, have the students build small models of the *Saturn V* launch vehicle. Use cardboard tubes for the body, a cone-shaped paper cup for the nose, light cardboard for fins, and pieces of plastic drinking straws for the engines. The students may write a story or play about launching their rockets and what it carried (payload) or helped to launch.

4. One *Skylab* crew spent Christmas in *Skylab*. Form student groups and let them choose a holiday and plan a celebration for a *Skylab* crew. Remind them to think of the small area, limited storage, and weightlessness.

For more information about what resources are available for classroom teachers, contact: The Education Resource Center, Office of Education P-700, National Air and Space Museum, Smithsonian Institution, Washington, D.C. 20560. Tel. (202) 786-2109.

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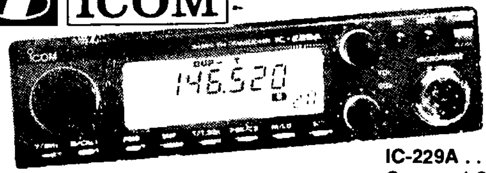

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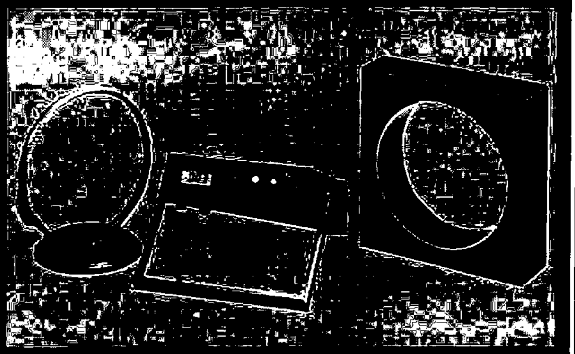

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The Last of the HW-9!

I was checking my electronic mail from CompuServe one night and there it was, a note saying Heathkit will be dropping the HW-9. The good *do* die young. I have no idea how many HW-9s have been sold, but they were a very popular QRP radio. After logging off CompuServe, I got somewhat misty-eyed and brought down my little green HW-8. Ah, yes! This is QRP if ever there was.

After finding the power cord and a suitable length of coax with an RCA plug on the end, it was QRP time on 40 meters. But something was wrong. For the life of me, I could not make a single contact with anyone. Off went the cables, and the HW-8 took a trip to the repair bench.

With Heath gear, I always like to go through and check out the alignment. Any trouble areas will easily pop out. In my case, several trouble areas came right up to the surface.

The first problem was with the VFO. It was way off frequency. Heath has a strange way of calibrating the HW-8 that is both time-consuming and hit or miss. Heath wants you to zero beat the output of the VFO to a receiver tuned to 7.0 MHz or 7.250 MHz. You end up moving two VFOs—the HW-8 VFO and the receiver's VFO. This is a real pooper! There's a better way to do it.

Tuning the HW-8

You'll need a frequency counter and some patience. The VFO generates frequencies from 8.645 MHz to 8.895 MHz. A good place to tap the VFO is on the emitter of Q3, the emitter follower, of the VFO. From here you'll be able to see the exact frequency the VFO is running at. Then it's time to play cat and mouse. The VFO must be adjusted to operate properly. Follow the instructions in the manual.

Basically, you move the VFO to one end of the band, adjust trimmer capacitor C302B (the screw adjust on the main VFO capacitor), and move the VFO to the upper end and adjust L9. You keep going back and forth until the zero on the dial and the 250 mark fall exactly on 7.000 MHz and 7.250 MHz, with the band switch in the 7.0 MHz position, of course. With a frequency counter connected to Q3, the values will be 8.645 MHz and 8.895 MHz.

It's easier said than done. No matter how I tried, I could not get the VFO to track 100 percent. The slug in L9 would not turn smoothly enough. It snapped back and forth. I ended up with the high end of the band out of alignment just a tad.

My reasoning is that most of the activity for the HW-8 is on the CW bands, and that that is where the VFO should be most accurate. It works for me.

When working on the HW-8's VFO, be sure to allow ample time, so the VFO can warm up to operating temperature. Use a stable power supply, not dead batteries. After I got the VFO back in line, the second problem came up to bite me: no VFO transmit offset.

When the HW-8 goes to transmit, diode D11 effectively adds capacitor C55 to the VFO, which causes a downward shift to the VFO frequency. This should produce a fixed offset of 750 Hz during transmit. In my HW-8, C55 did in fact get switched into the VFO. Only trouble was, the offset was 3 kHz, not the desired 750 Hz. Useful, but hardly interchangeable. The offender was C55. It changed value. The fix was simple: Replace C55 with a good capacitor. But I went one step further. I tried adding a small value trimmer capacitor in place of C55.

Experiment, Experiment

My thinking was simple: adjust the trimmer capacitor to the offset I wanted. But it didn't work! The trimmer changed the alignment of the VFO. The trimmer was not stable enough to use on the air. All in all, a pooper and a half. Heath's value of 6 pF is a good value to stay with. I ended up using 5 pF and having a 730 Hz offset. Capacitor C55 is kind of hard to get at. I removed the old one and soldered the new one on the trace side of the PC board. Bent down on the board, the capacitor fits quite nicely.

To see how much offset you have during transmit, connect your counter up to the emitter of transistor Q5. Here you'll see the exact operating frequency of the HW-8. During transmit, C55 shifts the transmitter down. You'll see this shift at this test point. As a thought, here would be a good place to add a buffer/amplifier for a digital readout, replacing the analog dial in the HW-8. I can see it now. An LCD display instead of the plastic dial used now.

When I brought out the HW-8, I had to dig up the 2000 ohm headphones required. I found them in a dark corner of the basement. After 15 minutes of use, I remembered why they were in a dark corner of the basement. With this thought, how about some modifications for the HW-8?

The most common mod for the HW-8 is the addition of a small grain-of-wheat bulb behind the meter. It makes a super "on" indicator. Use a small terminal strip to hold the bulb in place. Tap +12 volts from the power switch and use the chassis for negative return. Simple, but really first class.

Building an S-Meter for the HW-8

This modification is simple and easy to build. With easy to come by parts, we can have an S-meter for the HW-8. Granted it's not the best S-meter in the world, but it's an S-meter nonetheless. The circuit consists of nothing more

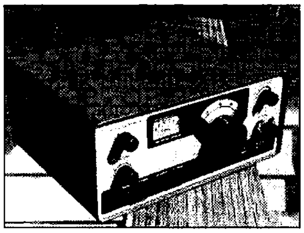

Photo A. The green QRP box, the HW-8, is a solid performer even on today's band.

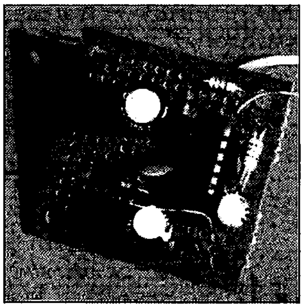

Photo B. The 2 watt audio amplifier assembled on perfboard.

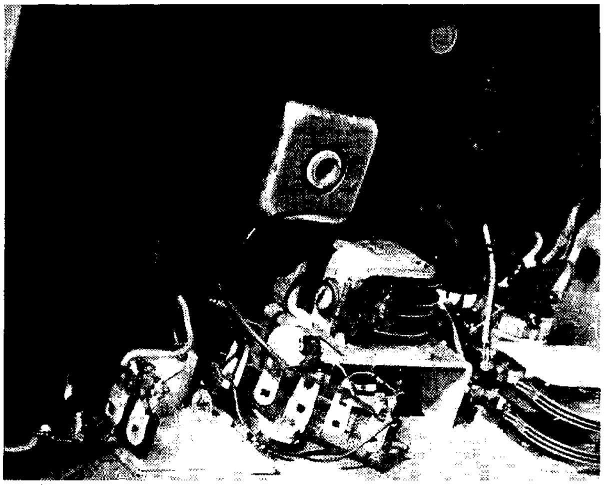

Photo C. Terminal strip holding the S-meter parts. The grain-of-wheat bulb is barely noticeable behind the meter's face.

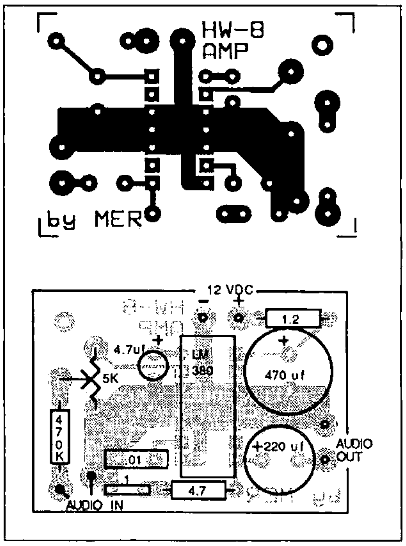

Figure 3. (a) PC board foil pattern for the audio amplifier. (b) Parts placement.

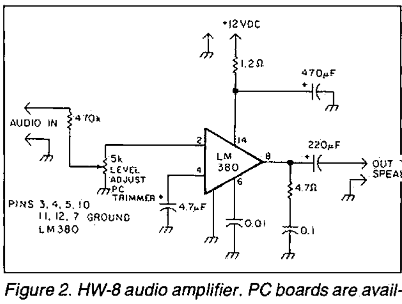

Figure 2. HW-8 audio amplifier. PC boards are available for $3 + $1.50 postage from Far Circuits, 18N640 Field Court, Dundee IL 60118.

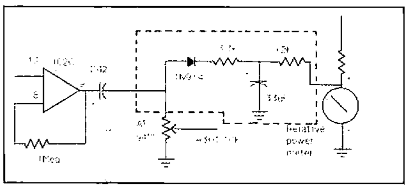

Figure 1. An S-meter for the HW-8.

than two resistors, a diode, and a capacitor.

Here's how it works. We steal a small amount of audio from the volume control at the junction of C42 and the pot. The diode rectifies the audio while the 33 µF capacitor smooths out the signal. The DC level is then connected to the plus side of the meter via the 12k resistor.

You may want to change this value to suit your needs. I found the 12k value to work well for me. This S-meter does not in any way affect the operation of the meter during transmit. The louder the signal, the more the meter moves. No one is really S-9, but the meter can be used to center the VFO to the audio filter by tuning for maximum reading. Besides that, it is great to watch the meter do something when the HW-8 is receiving.

Wanting a simple method for driving a speaker is nothing new for the HW-8. Here is my version based on the LM380, a 2 watt audio chip. This chip has lower internally generated noise than the popular LM386. The chip is widely used for audio power amplifiers in Ten-Tec radios. Here is my version, simple and easy to get running. Not much need to explain how it works. Audio from the headphone jack is routed to the amplifier board. A 5k trimmer adjusts the level going into the board. I wanted to be able to operate both the internal power amplifier and the headphones, whenever desired.

I adjusted the trimmer to supply a good level to the headphone jack and the internal amplifier. A small circuit board was used. One-hole mounting or a piece of double-sided tape works well, too, with the board mounted close to the headphone jack.

The power plug on the HW-8 has six conductors, of which only two are used for power. Here I took advantage of the extra pins and routed the power from the HW-8 to the audio amplifier via the power plug.

The power switch is external to the HW-8, and is in fact part of the power plug. The audio to the speaker is also routed to the last two pins—no need to drill holes in the HW-8 this way. By making up two different power plugs, you can run with headphones-only in the woods, then return home and plug into the internal audio amplifier and external speaker.

After these simple modifications, the HW-8 was back to its former self, banging out QSOs one after another. So what does this all lead to, you ask? Well, don't you know, there are many more modifications for the HW-7, HW-8, and the HW-9 in the HW-8 *Handbook.* Get your copy from me for $7.95 plus $1.00 postage at the address above.

What's in store for next month? Beats me. I'm heading out to the local K-Mart with my camera. Heard on the scanner that Elvis was seen there working in the shoe department. What a country! 73

Special Events *Continued from page 58*

the largest hand-cut stone building in North America. For certificate send QSL and 9x12 SASE to ***C.A.R.A., 303 Spring St., Weston WV 26452.***

OLD FORT SUMNER, NM The Eastern New Mexico ARC will operate KA5BAT 1500Z-0100Z from the Billy the Kidd Museum in commemoration of the 110th anniversary of the demise of Billy the Kidd. Operation will be on the General phone bands on 15, 20, 40 meters, and around 28.400 on 10 meters. For a certificate, send QSL and a 9x12 SASE to ***Leroy Thomas KA1ULG, 1479A Mindoro Ct., Clovis NM 68101.***

JUL 13-14

FULTON, NY The Oswego County AR Emergency Service, will operate KY2F, 1300Z-1900Z Sat. & Sun. from the Central New York International Air Show at the Oswego County Airport. Operation will be in the General 20, 15, 10, and 2 meter bands and the Novice portion of 10 meters. For certificate, send your QSL card and a large SASE to ***Fred Swiatlowski KY2F, PO Box 5227, Oswego NY 13126.***

JUL 14

HASTINGS, EAST SUSSEX, ENGLAND The Hastings Electronics and Radio Club will operate Station GX6HH/P to demonstrate amateur radio to girls (aged 11-18) and visitors at a Grand Fete at Helenswood School on the 14th. They will also be QRV on July 13th. The girls will be designing their own unique QSL card which will be sent for each contact. QSLs to be via ***Gail P. Stevens G0GRK, 33 Langham Rd., Hastings, East Sussex, TN34 2JE, England.***

JUL 20-21

HAMBURG, NY The South Towns ARS will celebrate the 106th "Birth of the Hamburger" with club station WB2ELW operating 80 through 15 meters lower portion of General phone and 28.415. For QSL and commerative certificate, send SASE to ***WB2ELW, 6120 McKinley Parkway, Hamburg NY 14075.***

LAKE ITASCA, MN The Paul Bunyon ARC will operate a Special Event station Sat. from 0000Z-0000Z Sun., from the source of the Mississippi River, in commemoration of the Centennial of Itasca State Park and the State Park System. Operation will be SSB in lower part of the General range on 80-10 bands (excl. WARC). For a multi-color 8½ x 11 certificate, send QSL, SASE and contact number to ***KE0RR, Rte. 1 Box 152, Winger MN 56592.***

JUL 27-28

CANTON, OH The Canton ARC will operate Station W8AL to celebrate the Pro Football Hall of Game Greatest Weekend from 1300-2300 UTC Sat. & Sun. Frequencies: 28.350, 21.350, 14.270 and 7.270 SSB, ±QRM. SWL's welcome. For an unfolded certificate, send your QSL and a 9 x 12 SASE with two units of First Class postage. For a QSL or folded certificate, send your QSL and a #10 business size SASE to ***Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306.***

PORT HURON, MI The Eastern Michigan ARC will operate Station K8EPV from 1400-0200Z Sat. & Sun., to commemorate the 66th Port Huron to Mackinac Island Yacht Race. Frequencies: 3.910, 7.235, 14.235, 21.335. Phone 28.335; CW 3.710, 7.110 and 21.220. For certificate, send large #10 SASE with your QSL to ***Eastern Michigan ARC K8EPV, H. Kohl, 1640 Henry, Port Huron MI 46060;*** or ***801 Range Road, Port Huron MI 48060.***

ROCKLAND COUNTY, NY The Crystal Radio Club, in celebration of its 60th Anniversary, will operate W2DMC from 1200-2400 UTC July 27th and 28th. Phone: 7.250-, 14.300-, and 28.450 MHz. CW: 7.050- and 14.050 MHz. For commemorative certificate, send QSL with SASE to ***W2DMC, PO Box 482, Valley Cottage NY 10989.***

JUL 28

EAST AURORA, NY The Pioneer Radio Operators Society will operate N2IFG from the village park during its 15th annual celebration of East Aurora "Racing Day," remembering its heritage as the trotting horse capitol at the turn of the century. Frequencies will be 3853, 7244, 14244 & 21344 kHz from 1600-2200 UTC. For a special QSL send a SASE to ***N2IFG, 42 North Willow St., East Aurora NY 14052.***

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CIRCLE 231 ON READER SERVICE CARD

Ask Kaboom

The Tech Answer Man

Michael J. Geier KB1UM
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Knobs, Buttons and Switches

No matter what kind of gear you're running, one thing is sure: It is controlled through switches and/or knobs of some kind. Even computers, with their inherent software approach, gel down to human business via buttons, mice, keyboards, or some other mechanical arrangement. Until practical voice input control comes along or touch screens become popular, knobs and switches will continue to be the way to go.

Given their mechanical nature, it is not surprising that switches and controls are frequent sources of trouble. Many times, a "serious" problem will turn out to be nothing more than a dirty control or a flaky switch. Let's look at how and why these things happen and how to find and fix them.

On Again, Off Again

Simple on/off switches, which do no more than make and break circuits, come in a variety of styles. Each type is subject to its own peculiar failure modes.

Toggle switches, similar to the normal "light switch" style, rely on contact pressure for connection. The actual contact is usually on the side of the switch opposite the handle's pointing direction, because the handle is pivoted at its midpoint. The pressure, applied by a spring in the handle, is usually considerable.

The most common causes of failure of toggle switches are contact corrosion and bending of the contacting element. I've seen both. Corrosion is nearly always caused by excessive current through the switch, especially if it is applied while the switch is being turned on or off. (And after all, that is the point of a switch, right?) The effect is a "blackening" of the contact points and a poor or nonexistent connection, no matter how much pressure is applied.

An extreme example of this phenomenon occurs in really heavy-current applications like HF linear amplifiers. If the switch is turned on precisely when the AC current phase coming from the wall happens to be at its peak, the inrush current can be enormous, and the switch can actually weld itself permanently closed! My MLA-2500 amp has done this several times. Once it happens, the only way to shut it off is to unplug it!

Even then, the switch remains firmly welded "on," although this particular one can be pried apart with a screwdriver because its innards happen to be accessible. The best cure is a new switch, but it, too, can be welded in short order. When replacing a welded switch, always use the highest-rated one you can get, and make sure that it is rated for more current than the one you're replacing. On my amp, I've taken to using an outboard switch on a heavy-duty power strip.

Another cause of corrosion, more common in slide switches but also seen in toggles, is the drying out of the original lubricant. I don't know the name of this stuff, but there is a grease-type substance applied to many switches' contacts (especially those of Japanese origin), and it dries out over a period of five or more years. When dry, it resembles a hard black tar, and it is *not* conductive.

Assuming you can get the switch open, the obvious temptation here is to scrape the contacts clean. Beware: Many switch contacts, especially the high-current-capacity type, are plated. Scraping usually will remove the plating along with the problem. The switch may work fine, but it won't work for long. Without the plating, it will quickly corrode and go bad. If you *must* scrape, do it as carefully as you can, with fine sandpaper.

Another approach is to dab on a small amount of a powerful tarnish remover, such as Tarn-X™. This stuff is basically diluted acid, and it will clean those contacts to like-new status. It may also eat through the plating and the nonmetallic switch components, so be sure to wash your work off with plenty of water after a minute or so of the tarnish remover. Also, read and follow all the warnings printed on the bottle; this is not stuff you want to be careless with.

Slide on Over

Probably the most troublesome type of switch is the slide switch. These beasties are used for many things, including transmit/receive switching and band switching. They are chosen for these jobs because they can easily be made to have many poles which all switch at once, but they are much smaller than rotary switches. A big slide switch may have six or even 10 or more poles, each one a double-throw, yet be small enough to fit into a miniature radio.

The prevalent failure mode in slide switches is corrosion. Although their connections depend on the pressure of tiny fingers sliding along a long bar, the contact pressure really isn't strong enough to keep things clean through the resulting scraping motion. The fingers seem to keep their springiness for many years, but the bars get quite ugly. The primary cause seems to be that darned lubricant again. Also, simple oxidation and, of course, cigarette smoke residue take their toll. If you have an intermittent band switch, check its connections to the board first. If they are OK, the likely cause is contact corrosion.

Radio Shack and others sell sprays which are supposed to degrease and clean switch contacts. My success with them has been marginal at best. Sometimes they can help in a switch which has just started to malfunction, but usually they have no lasting effect. And I have yet to find a spray which will dissolve that black hard lubricant tar.

So, what's to do? Far and away, the easiest and best solution is to get another switch! It may look like a big hassle to replace a six-inch-long band switch with 30 contacts but, believe me, it is easier than the emergency method I am about to describe.

Ready, Doctor?

OK, you've got a bad band switch and you either can't get another one (you mean they don't still stock parts for that Yamasutsi 1972 special??) or you don't want to wait through the long ordering process. I ran into just such a case with a Panasonic shortwave receiver made in 1978. It was a nice little radio, but the band switch had gone bad, resulting in its not doing much of anything at all. Spraying did no good, so I decided to take the plunge and do surgery on the switch. Be warned: This is not for the faint of heart nor squinty of eyesight. Here's how to do it.

The first order of business is to remove the switch from the rig. Get some desoldering wick and carefully disconnect the offender, contact by contact. Usually, the metal body of the switch will be soldered at its corners to ground traces on the board, and you'll have to unsolder those, too. Once you have the switch out of the rig, the fun begins.

The bottom of the switch will probably be made out of a plastic or phenolic material similar to that used to make printed circuit boards. Extending around it at the edges will be metal tabs protruding from the metal top shell. Very carefully, bend the tabs back just enough so that you can remove the casing. Don't bend them all the way—it isn't necessary and greatly increases the risk of their breaking off. Now, gently pull the shell away from the bottom. Be prepared for some of the internal switch fingers to fall out. They are quite small, and if you lose one, you have ruined the switch! Keep a cup or other container handy to store them. Also, if the slider is spring-loaded, uncontrolled release can result in switch parts all over the room! Go slow.

Most of the fingers probably will still be on the center rods. Gently pull them off and put them away. The objects of your attention are the flat center rods around which the fingers were clasped. Most likely, the rod surface will be brown or black. This is the stuff you want to remove. Probably the best method is the tarnish remover. Clean everything up, wet it down and let it dry completely before proceeding. While the piece is drying, take a look at the switch fingers you removed. They should look OK but if they don't, try wetting a piece of paper with some spray contact cleaner (*not* tarnish remover) and sliding it between the fingers. Be very careful not to bend them apart. Then, let them dry, too.

When you're ready to reassemble the switch, replace the fingers on the center rods. Look at the slider and you will see the indentations where the fingers belong. You must position the fingers on the rods such that they will line up with these indentations. Don't try putting the fingers into the indentations and then pressing the whole thing onto the rod; you will bend or break the fingers. If there's a slider spring, put it in place now. Line up the shell and gently try to push the phenolic into it. If it resists, one of the fingers probably is not lined up correctly. Never force the assembly or you'll break it. Reseat the finger and try again. This is the most difficult part of the operation.

Once you've got it back together (and you're sure it's right), press the shell's securing tabs back over the phenolic and you're all set. The switch should be good as new! As you can tell from the description, this procedure is risky and hardly worth the effort unless you have no choice. But I've used it a number of times and saved some nice gear.

Around and Around

Rotary switches are basically round slide switches, and they suffer similar failures. They present some unique problems, though, because their construction can make access difficult. If you can get to the problem, which is almost certainly corrosion, try some cleaning spray. If that won't do it, dab on the tarnish remover. Unfortunately, you usually can't wash the switch off properly afterward, because it is still in the rig! Dab as much water on as you can and pat it off with a paper towel. Needless to say, let it all dry *completely* before turning on the power! I don't recommend disassembling rotaries, or even trying to remove them from the rig, especially if they are of the multi-level type, which most are. It's just too difficult, and the chances of getting it all back together again without causing other damage are small.

Push My Buttons

Push-buttons come in many forms, from the old-fashioned round long-travel type to the modern membrane variety. Some push-buttons are really slide switches in disguise. A quick peek behind the front panel will tell you for sure. The old long-travel types are so plentiful that it just doesn't pay to try to fix them. Besides, I've never had much luck with fixing one; the switch always wound up working, but not reliably.

Membrane switches, as used on modern HTs and HF rigs, are very reliable. The usual cause of failure is from having something (typically soda) spilled into them. If you can, order a new keypad. if not, you can often pull them apart by peeling the adhesive layers from each other. A good cleaning with some tape head cleaner will usually restore these pads to normal. Just be sure to line the two halves up properly before you press them back together.

See the Light

Optical encoders, used for tuning today's microprocessor-controlled HF rigs, are not mechanical switches at all. They employ a pair of LEDs and photodiodes in an interrupter arrangement. As you spin the dial, a slotted plate alternately passes and interrupts the light to the photodiodes. Each blip of light represents some fraction of a turn. The direction of the rotation is determined through a clever scheme: The light paths are arranged so that one changes state while the other is halfway through its position. Rotating the dial clockwise will cause one photodiode to detect a change before the other, while rotating counterclockwise will reverse the order. It is a simple matter to decode the changing states into direction and speed information. By the way, most computer mice use this arrangement.

The usual cause of failure in optical encoders is electronic, rather than mechanical. Either an LED or photodiode goes bad, or the associated decoding circuitry fails. In either event, new parts are called for.

Well, there are several other kinds of switches, including microswitches and relays. Also, there are potentiometers, and they are among the most troublesome of all components. We'll continue this exploration next month. 73

Number 28 on your Feedback card

ATV

Ham Television

Bill Brown WB8ELK
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Shuttle ATV Success!

During the STS-37 mission last April some record breaking contacts were made via 70 cm ATV. Six selected stations in all made the attempt to uplink live video to the orbiting shuttle during several passes over the U.S.

Considering that the shuttle was using a window-mounted antenna and the distances that needed to be covered (at times over 1500 miles), the uplink sites had to mount a massive effort to generate the most ERP (Effective Radiated Power) possible. The individual stations generally ran 400 watts or more. Some of the sites also used multiple antennas (or a 40-foot dish, in the case of the Goddard U.S. Naval Academy site—see the photo of this dish in the May "QRX" column). The stations making the attempt were Jim Steffen KC6A in Long Beach, California; the Johnson Space Center ARC W5RRR in Houston, Texas; Andy Bachler N9AB with the Motorola ARC in Schaumburg, Illinois; the Marshall Space Flight Center ARC WA4NZD in Huntsville, Alabama; Goddard Space Center ARC WA3NAN in Greenbelt, Maryland (the Goddard group also uplinked via the U.S. Naval Academy dish in Annapolis, Maryland) and Kai Siwiak KE4PT representing the Motorola club in Ft. Lauderdale, Florida.

The first scheduled attempt was unsuccessful due to the position of the orbiter. However, orbit 32 was a different story! Jim Steffen KC6A started out the pass with great reception by the *Atlantis* even when it was far out over the Pacific Ocean. Jim was running a K2RIW amplifier running 600 watts into a single KLM-18C. Next, the Marshall group WA4NZD sent some excellent video up to the shuttle showing the club members who helped set up their station (see the June "QRX" section for a picture of the group and their antenna system).

Andy N9AB next sent up a video tape of the liftoff of the *Atlantis*. This marked the first time any shuttle crew has been able to view their liftoff while still in orbit! Andy was one of the furthest stations away from the orbiter due to his northern location near Chicago (elevation angles of only a few degrees). He ran a kilowatt into a 16-bay array of quagis to make up the difference.

Due to the success of this scheduled uplink, the next morning another opportunity was made available. The crew on board *Atlantis* first received a taped uplink from N9AB of a local school's shuttle mission simulation (the Millburn School in Wadsworth, Illinois). Next the Goddard/U.S. Naval Academy group was able to send up a nearly snow-free COLOR signal. Of course, the Henry amplifier and the 40 foot dish may have helped a little! At the end of the tape recorded on board the shuttle, a very weak image of a SAREX patch could be discerned. This was sent by Kai Siwiak KE4PT in Ft. Lauderdale, Florida. The Johnson Space Center ARC W5RRR video effort was not seen on the shuttle's videotapes (although it may well be viewable upon further analysis). The JSC effort was undertaken by T. Brad Smith KA5CDJ and others in the club.

Thanks to the efforts of Gerry Creager N5JXS, we can show you still frames of the actual videotape as received on STS-37. Gerry printed Photos A–D out on a SONY UP500B videoprinter. While they may seem rather snowy at first glance, keep in mind that the actual video appears clearer since the eye tends to average out some noise.

How It All Began

After the SSTV experiments on STS-51F by Tony England W0ORE, fast-scan TV seemed the next logical step. Back in early 1987, Andy Bachler N9AB discussed the idea with Lou McFadin W5DID and decided that the experiment would be feasible. The Motorola ARC (Illinois chapter) put together a proposal (building on a previous proposal by Art Anzic K8BVI from the NASA Lewis Center) and Andy submitted it in May of that year.

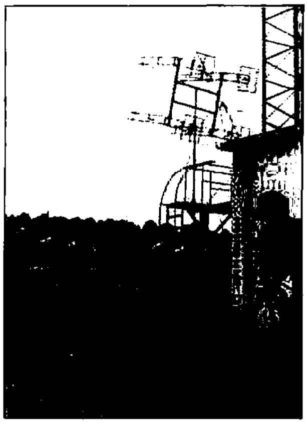
While the FSTV project was underway, a need for a new side-window-mounted shuttle antenna for the STS-35 mission arose. A dual-band antenna which allowed simultaneous 2 meter operation and 70 cm FSTV receive was designed and built by Jim Phillips and Andy Bachler N9AB at Motorola in Schaumburg, Illinois.

Photo A. Jim Steffen KC6A as received by the shuttle Atlantis

Photo B. The Marshall Amateur Radio Club sends their best to the shuttle.

Photo C. N9AB reception by the shuttle. Eighth grade student Chelsea Papangian (Millburn School in Wadsworth, Illinois) makes her debut as simulated mission commander.

Photo D. A nearly snow-free signal in full color was received from the Goddard/US Naval Academy effort WA3NAN.



Bill Bily WB9DIG built the prototype shuttle ATV downconverter using parts of a Motorola HT and TV IF circuitry suggested by Tom O'Hara W6ORG. With the aid of Fred Reimers N9ETW (also known as FAR Circuits), the downconverter was built on a custom PC board to produce a very compact package which integrated nicely with the rest of the SAREX equipment.

Future Possibilities

Enhancements to the shuttle's receive system and ground station capabilities should result in even better performance in future missions. A lot has been learned by this experiment, and it's hoped that it can be flown again in the near future.

Photo E. Marshall Amateur Radio Club members with their four-bay helix array in background. (l to r): Ed Stluka W4QAU, Don Hediger N4MSN, Eddie Crawford WA4QKC, Gene Marcus W3PM, Terry Jones NZ8C, Tim Cunningham N8DEU, Randy Galloway KN4QS, Larry Savage WA4CAX and Dick Christiansen KK4HF (behind the video camera).

Photo F. Pure power—the uplink transmitter at the U.S. Naval Academy/Goddard site. Combine this with their 40-foot dish and watch out! Photo by Bob Bruninga WB4APR.

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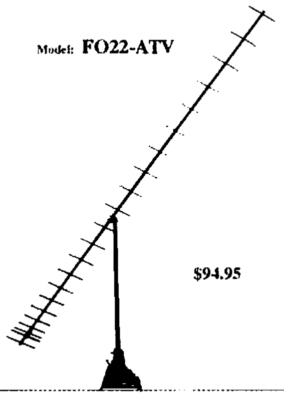

ELECTRICAL SPECIFICATIONS:
Gain bandwidth .... 420-450 MHz
VSWR < 1.33:1 415 to 450 MHz
E-Plane beamwidth .... 23 Deg.
H-Plane beamwidth .... 24 Deg
Sidelobe attenuation
1st E-Plane .... -17.5 dB
1st H-Plane .... -15.5 dB
Maximum power .... 1500 Watts
F/B ratio .... 22 dB
Impedance .... 50 ohm

MECHANICAL SPECIFICATIONS:
Length .... 14 Ft
Boom .... 1" OD 6061 T-6 Al
Elements .... 3/16" Al rod
Mast .... up to 1.5" dia.
Wind surface area .... .78 Sq.Ft.
Wind survival .... 90+ MPH
All Stainless Steel Element Hardware
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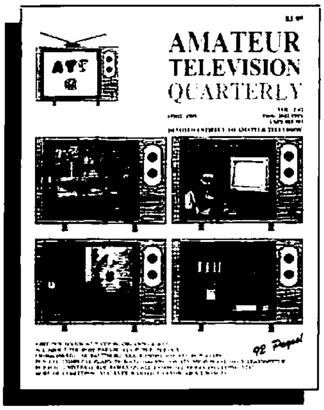

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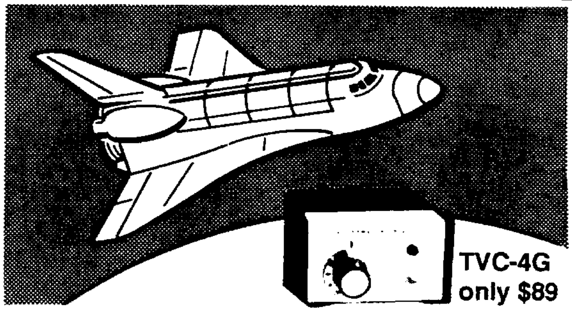

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Fastnet Rock Lighthouse

Look for a unique expedition this July from the Fastnet Rock Lighthouse just off of the southern coast of Ireland. As one of Europe's most westerly and loneliest outposts, the lighthouse has been an important gateway for transatlantic shipping since 1854. Since the "Rock" is lashed by the full force of Atlantic gales (even during the summer), a boat landing is possible only 12 times a year. The group plans to ferry all radio equipment and supplies over by helicopter on July 9 and continue operations for 10 days.

The expedition will operate under the callsign EJ7FRL (Fastnet Rock Lighthouse) on the following frequencies: SSB—3.775, 7.075, 14.140, 14.240, 21.275, 28.450 and 144.260 MHz. CW—3.510, 7.010, 14.010, 14.030, 21.010, 21.030, 28.010, 28.030 and 144.040 MHz. Also look for the group on 160m and the WARC bands. The IOTA (Islands On The Air) reference number is EU-121. QSL via EI2BB. *[Thanks to EI3GU for the above information.]*

More DX Techniques

No doubt you heeded my suggestions made in last month's article, and listened very carefully to each DX station before calling. Remember, I said *listen, listen, listen!*

Yes, listening is the name of the game, then putting your signal where the DX station is listening. You must understand what the operator is going to do next, how the operator is working stations, and where the operator is listening. Otherwise you will be playing DX roulette, and you will probably spend many frustrating, even fruitless, hours calling, calling, and calling, but never working the DX station.

If the DX station is working stations in split mode (he is working stations above or below his own transmit frequency), you should find the stations he is working, and note whether these stations are on the same frequency, or higher or lower, each time.

An experienced DX operator with a reasonable pile-up will work stations progressively higher (or lower) in frequency each time until he reaches the limit of his "listening window," which may be 5 to 10 kHz wide, or even wider. When he reaches the limit of the window, a DX operator will usually move back to the beginning of the window and start moving up (or down) in frequency again. A rare DX station will usually have a large to gigantic pile-up to work, and may be listening over a much larger window, up to 50 kHz wide. The wider the window, the more difficult it is for us to work the DX station.

It is very helpful if you can monitor both the DX station and the pile-up simultaneously. Some modern transceivers offer this capability, otherwise you must use an extra receiver. You can drive one earphone from one receiver and one from the other receiver.

As soon as the DX station signs over to a station, start searching the pile-up to locate the lucky operator. But don't be fooled by the odd operators who send "599" or "59" and are not actually working your DX station. There are always a few in every pile-up who insist on confusing matters by sending bogus reports. There may also be other QSOs taking place within the window, or more than one pile-up taking place in the same area of the band.

Second Guessing

Okay, so you have found the stations he is working. If you are lucky, you can transmit on or near that frequency and work him. But it is better to listen to several contacts and determine just how far he moves his receiver each time, and whether he is working more than one station on each frequency before moving on. You are trying to guess what he will do next.

When you have determined his pattern, you are ready to put your callsign on the correct frequency and hopefully work him within a reasonable period of time.

One suggestion—if you are calling, but haven't worked him within a reasonable period of time, say 15 to 20 minutes—either you may not have figured out his pattern, or you have, but too many other DXers also have. Another possibility is that propagation is not favoring your area. Take a break. Come back to the pile-up in 15 to 20 minutes with a new attitude—listen, learn his pattern, and get him!

If you have been unable to figure out his pattern, you may sit on one frequency and call each time he says "over" or "QRZ." This is a poor technique, but sometimes it works. Though this is an unsophisticated technique, it is especially effective if you have a commanding signal and are on a relatively clear frequency. I have worked several DXpeditions this way when I could not figure out the pattern, but knew they were tuning through a window of frequencies.

It is also a useful technique to use for a DX station who insists on spreading their pile-ups over a large window or who use a channel technique where the operator listens only on spot frequencies (channels) located every 10 kHz or so. This so-called channel technique can be extremely difficult for calling stations, and usually spreads the pile-up over a large portion of the band, since most of the calling operators don't know the channel technique is being used.

Pile-up Don'ts

There is also a long list of pile-up don'ts.

Don't make long calls; keep your calling sequence short and sweet, especially if the DX station is working stations very quickly.

Don't transmit on the DX station's frequency if he is working split. No matter what you say, someone will almost always respond, often in an unkind or insulting manner.

Don't respond to jamming or insults.

Don't transmit when the DX station is transmitting.

Don't transmit when the DX station requests a particular callsign fragment ("W5K," "last letter echo," "Europe only," etc.) unless, of course, the request matches your callsign or geographical location.

Don't mention your name, QTH, etc., unless the DX station requests such information.

Next month we'll discuss some techniques for special situations and go over some DXing how-to books.

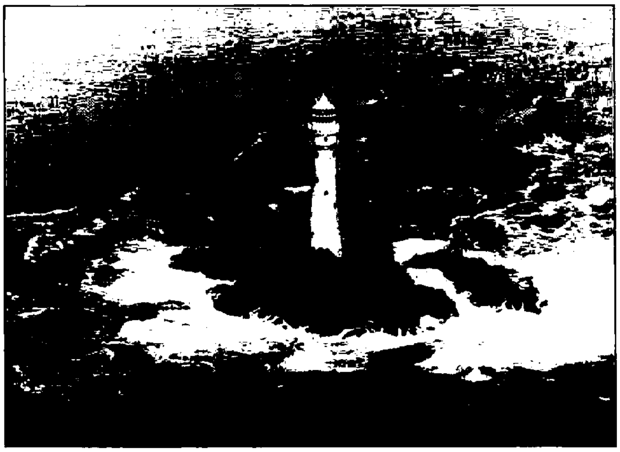

Photo. The Fastnet Rock Lighthouse expedition (southern Ireland).

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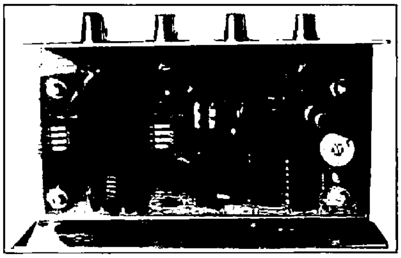
UPDATES

June Photo Switcheroo

As we were all on our way to the Dayton Hamvention, the gremlins decided to have a little fun with two of our articles. In the June issue, Photo A on page 10 and Photo A on page 34 somehow got mixed up. To correct this, we offer a cut-and-paste solution! Since the photos are the same size, just cut out the attached photos and paste them in the correct article. If you don't want to cut up your magazine, just photocopy them.



In the June Issue, the top photo should be placed over Photo A on page 34. The bottom photo should be placed over Photo A on page 10.

Michigan Scanner Law

See the May "QRX." John Evanish N8LBD writes: "In your 'QRX' in the May '91 issue on scanner law, you said [Michigan] law exempts licensed amateurs except for Novices and Technicians. This is incorrect."

According to a copy of H.B. No. 4750, Sec. 508, which John N8LBD sent with his letter, Technician Class operators are also exempt.

Number 31 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Odds and Ends

I met several hundred of you at Dayton this year. Thanks for all the kind words about the magazine and this column.

—— • ——

Radio Fun is succeeding beyond even Wayne's wildest dreams (and Wayne has some pretty wild dreams!). The premier issue sold out in about three weeks, though your local ham store may have a few copies left. Subscription orders are coming in by the bagful every day. Look for the start of monthly publication with the September issue.

—— • ——

Despite the fact that our advertisers are reporting incredible sales from their ads in *73*, there are several companies that remain conspicuous by their absence from these pages. Companies like Ten Tec, Cushcraft, Radio Shack, Kantronics, Standard, Ham Radio Outlet, Henry Radio and Optoelectronics continue to ignore the fact that advertising in *73* will make money for them.

Some of the advertisers who *do* take out space in *73* will take out two or three times the space in *QST* or *CQ*. Why? I've always maintained that *73* readers spend more money than readers of other ham magazines. Many of our advertisers have recently reported this to be exactly the case. If you, patient reader, want to see a fatter *73*, it's up to you to make sure every amateur radio advertiser knows that you read *73*. That means that when you call a company for information, tell them you saw their ad in *73*. When you order a piece of gear, tell the person on the phone or behind the counter that you saw the ad in *73*. If a company is not advertising in *73*, write or call them and tell them you're interested in their product, but since they don't advertise in *73* you have no idea what they offer. It's no mystery. . . ad pages pay for editorial pages on a roughly 50/50 basis. When we have more ad pages, you get more great reviews, construction projects and all the other stuff you want. Give the above named companies a call—and any others you come across—and ask them why they're throwing away perfectly good money by not advertising in *73*. Then call me and let me know what they tell you.

—— • ——

I have a source at the FCC in Washington who informs me that there are several countries who are preparing WARC 92 proposals that would take away the entire 40 meter band. No, I'm not kidding. My source also informs me that many countries around the world are making recordings of American hams on 14.313 and the phone portion of 80 meters. They are planning to submit these recordings into the official proceedings at WARC 92 to support their proposals asking for the re-allocation of HF amateur frequencies to other services. Remember, every country gets only one vote at WARC. That means that when it comes down to the final tally, we have the same power as any small African, South American, Asian or Middle Eastern country (and these smaller nations desperately want our HF spectrum). While we Americans exercise our First Amendment right of free speech on the HF bands, we all ought to remember that other countries do not enjoy nor understand such a permissive right. With the right to speak freely comes the responsibility to use that right wisely. Think about it.

—— • ——

Donna DiRusso, the *73* Advertising Accounts Services Rep for the past three years, has been transferred over to one of Wayne's other magazines (*CD Review*). Donna has been the person who makes sure our advertisers are happy and she has done an outstanding job. We will all miss her very much. Sue Colbert is taking Donna's place at Ad Account Services. She is already cracking the whip and letting Dan and Louise (the *73* ad sales dynamic duo) know who's boss. Welcome to The Team, Sue.

—— • ——

My wife and I just bought our first house, so it looks like you're all stuck with me for at least the next 30 years (unless you want to help pay off some of the mortgage). It's a traditional Cape, nestled among the trees (but not too many trees), perched on top of a hill on three-and-a-half acres. The lot is a ham's dream. Oddly enough, a good radio sight was not one of the things we were looking for. It just happened that way. Really!

—— • ——

There's a group of hams down in Houston who are doing a great job of promoting amateur radio. They're called the Houston Amateur Radio Helpline and they've got some very nice PR pieces. If you want to see what can be done with a little imagination and very little money, drop 'em a line at 16410 Havenhurst, Houston TX 77059-5307. Their phone number is (713) 488-4HAM. Congratulations to the Houston area hams. We need more like you.

—— • ——

I was reading in one of the amateur radio news bulletins (I forget which one) about an organized effort by some packet radio groups to get the FCC to fire the guy who wrote the citations for passing commercial traffic on packet (remember. . . the 900-line message that circulated during Operation Desert Storm). Will someone please tell these people to knock it off. The last thing we need is to be causing the FCC more headaches with this kind of petty crap. The guy was just doing his job. He may have had some personal motive behind his actions, but I haven't seen any proof. The fines have been cancelled anyway, so what's the big deal? This gentleman did us a favor by showing how vulnerable our packet system is. So, instead of doing the typical stupid ham thing of screaming and yelling for this guy to lose his job (give me a break!), why don't we learn from this experience and either clean up our act or get a rule change?

—— • ——

As reported widely last month, there's a ham in Ohio who is in a whole kettle of hot water for interfering with police and other emergency communications. This guy apparently had a pretty sophisticated setup, with taped sirens for background noise and thousands of dollars of modified radio gear. His favorite game was to make a false "officer in distress" call, then watch the "fun" as a whole police department went into a panic trying to find an injured police officer who didn't exist. The thing that burns me about this whole story is the fact that this guy is a high school teacher and advisor to the high school radio club! Unbelievable! I hope this guy gets the psychiatric help he so obviously needs. I also hope that, if found guilty, he rots in a jail cell for a very long time.

—— • ——

Why is it that amateur radio manufacturers often advertise great looking new gear several months before it is available? I can understand advertising a bit in advance to generate interest, but some of our better known companies are taking this to ridiculous extremes.

—— • ——

I spend a lot of time on the air. If you ever hear me, don't hesitate to break in and say "Hi." If I'm home (and not mowing the three-and-a-half acres) on weekends, look for me on 40, 17 or the Novice or FM portions of 10. I usually check 28.365 MHz on the half hour, so try giving me a call. If you're a night owl, you can often catch me gabbing with N1GVA, N1GOJ and NU1W after midnight around 3.915 MHz (Friday or Saturday nights are your best bets). You can also find me on RTTY on 10, 15 and 40. Try the RTTY portion of 15 first. It's my favorite RTTY band. Don't be shy. I'd love to meet you. 73

Number 32 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

There's some exciting news this month: a total solar eclipse on July 11. The path of total darkness will cover the Hawaiian Islands and portions of Mexico. A partial eclipse will be viewable in S.W. Canada, the United States, except for the tip of Maine; Mexico and Central America; and South America, except for the Tierra del Fuego area. Then, on July 26, there will be a penumbral eclipse of the moon, which means it will only be in partial, not complete, shadow.

Propagation conditions during July ordinarily exhibit what we call the summer doldrums, since the HF bands for DX are not as lively as they are in spring and fall. Yet some excellent propagation can occur this month, so don't give up! July is typically a vacation month, and lots of hams will be portable or mobile on the HF bands. Expect plenty of short skip, especially on the most-used bands of 15 and 10 meters, but also on 20 and 40. . .and some DX, too.

As this is being prepared (late March, early April), the sun has been showing some remarkable activity. For the past month or six weeks, solar flux has been very high—more than expected—in the 200–300 flux units range. Also, there have been numerous large spot groups on the solar surface facing earth, accompanied by major flare activity. On some days, two and three major flares were recorded, and polar cap disturbances and proton events on earth or near earth have been numerous. Following the flares by two or three days, DX has been especially good on all HF bands, not bad considering Cycle 22 is now on the downswing. However, the spot groups are nearing the solar equator, a sure sign that Cycle 22 is drawing to a close.

Conditions this month ought to be fairly quiet, with fewer flares and magnetic field disturbances on earth. The 8th through 11th, and the 22nd through the 29th, are anticipated to be poorer days for propagation than the remainder of the month. As always, check WWV or the latest forecast at 18 minutes after each hour. Use the band-time-direction chart for planning your best times for DX operaton, and use the daily conditions chart to guide your decisions. Let me know how the eclipses affect propagation in your area. See you next month. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	—	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	[illegible]
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20(1)	20(1)	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40(1)	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20(1)	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20(1)	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20(1)	—	—	—	[illegible]	[illegible]	20(1)	—	—
U.S.S.R.	20	20	20	20	—	20(1)	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20(1)	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20(1)	20(1)	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	—	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	—	—	20	[illegible]	[illegible]	—	—
U.S.S.R.	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

Notes: (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

JULY 1991

SUN	MON	TUE	WED	THU	FRI	SAT
	1 G	2 G–F	3 G–F	4 G–F	5 G	6 G
7 G	8 G–F	9 F–P	10 P	11 P–F	12 F–G	13 G
14 G	15 G	16 G–F	17 F–G	18 G	19 G	20 G
21 G–F	22 F	23 F–P	24 F–P	25 P	26 F–P	27 P
28 P–F	29 F–G	30 G	31 G			

73 Amateur Radio Today

AUGUST 1991
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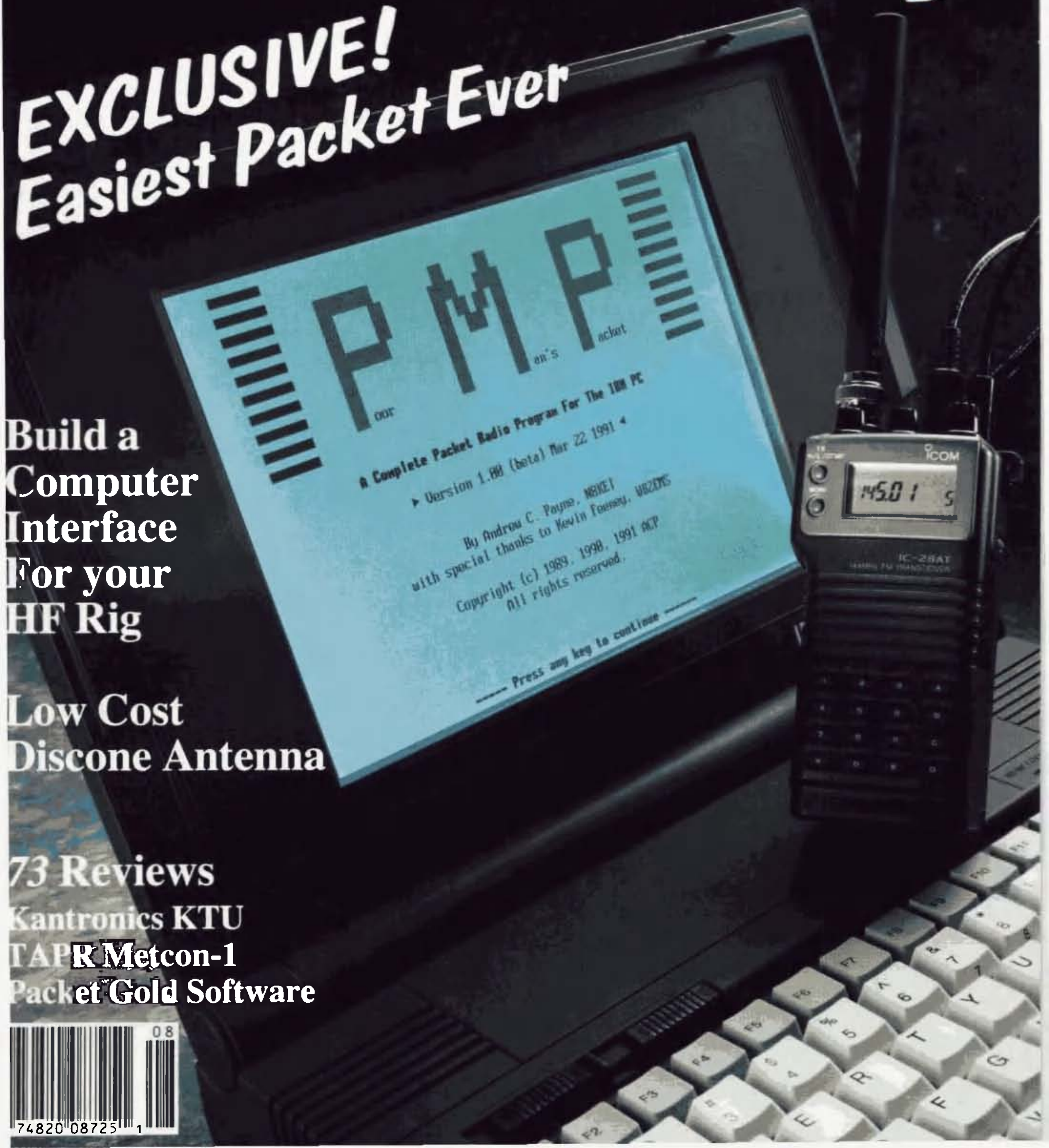

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LETTERS

From the Hamshack

George Fennell N3EQE, Butler PA A couple of other hams and I have started ATVing in Butler County and are having a ball. P5 audio and video is all around. This is the most fun I've had in ages. I just finished setting in a 10-foot parabolic to do EME and shuttle downlink (to rebroadcast on ATV) and am building a couple of transverters. I also bought a Kenwood 531A 1.2 GHz transceiver, and am building a small 24" parabolic antenna for that. To think that I could be missing all this fun while worrying about upgrading and building code speed. Maybe someday, but definitely not now. We're cooking with microwaves and having a blast. (Must avoid ionization of oneself—did you know that a crack in the waveguide of a 13cm, 1 kW amp 2 1/4" x 1/64" will produce energy 250,000 times the safe [?] exposure limit? WOW—that's what those cramps are!)

You should be starting some stuff for Radio Fun *to help get newcomers interested in ATV, 1200 MHz, and so on. Let's get on the ball and get more hams interested in doing fun things—and perhaps get them off the 20 garbage truck. . . . Wayne*

Ignatius N. Bova WA3GWD, Pittsburgh PA Mr. Jason Kelly's letter *[June '91 issue]* really irritated me. First, I would like to inform him that Morse code was included in the amateur tests for good reason. Our operators could get through under severe QRM using Morse code. Under emergency conditions, where ham operators are counted on to provide critical communications, this is a very valuable asset.

As for the existing amateurs being "a bunch of old men," I can only wonder how he would know. Do ham operators in Iowa give their age as well as their call?

Most ham operators are concerned, and rightly so, that some of the valuable ham bands could turn into another CB fiasco. Back in the 60s, like many ham operators, I read about all the wonderful things CB was going to do for ham radio. CB would "open the door" for many potential ham operators, and this would be the spark that would ignite new interest in this valuable resource. Baloney!

Mr. Kelly, I suggest that you listen in on the CB bands. It would be heart-breaking to have this happen on 2 and 6 meters.

The FCC does not have the resources to control the CB wasteland, and they certainly can't expect more funds with the federal budget bursting at the seams. If we get our bands run over by rude and careless operators, it is doubtful that the FCC could do anything about it, and we would all be the losers because of it.

First, re the code for getting through when conditions are tough. I've heard this claim for 50 years, and as far as I know, there is no authenticated case in the last 30 years of any amateur having to resort to code to get through in an emergency. Yes, of course it's possible it's just incredibly unlikely. With most of today's transceivers not even having a key jack, we may never know.

The old men complaint Kelly makes is echoed dozens of times a month in the mail I'm getting from new hams. It isn't difficult to discover age when you ask a chap what he does and he says he's been retired for 10 years. I finally ran into a non-retired ham last Saturday—first in months.

At a recent hamfest I asked for a show of hands of how many present with General or better licenses would be able to pass a 13 per exam right then. Ten hands went up out of the whole room. A few years ago I proposed as a joke that we all be re-examined for code speed every year. The reaction was one of total panic.

You say "rightfully so" about turning our ham bands into CB. This shows me two things: 1. You haven't listened to 20m for the last year or so. It's worse than any CB I've ever heard. 2. You haven't listened to CB in years.

CB did indeed help us enormously. Until CB came along, we had a negative growth for several years. Almost 100% of our actual growth in the last 20 years has come from people who got started in CB and moved up to hamming.

I'm just back from L.A. I've never heard anything as bad as their 2m repeaters on CB. . . anywhere. And I often take a CB rig with me for use in my rental cars when I travel. I find CBers usually much more helpful than hams if I need to find my way or make a phone call.

Of course, I haven't been to Pittsburgh in years, and you may have a pocket of bad CBers. But remember, only two people in history have been arrested, tried, convicted, and put in prison for bad language on CB. . . and both were Extra Class hams. It's almost enough to make a person think! But maybe not. . . . Wayne

Alan S. Koester NOCALL yet, Coral Springs FL I finally did it! Last night I passed the basic theory tests and became licensed as a no-code Tech. I am anxiously awaiting the arrival of my callsign. Like many others, I felt the code requirement was an obstacle I was not yet ready to overcome. I think that the no-code Tech license is an excellent way to get a taste of amateur radio. From what I have seen and read so far, once the amateur radio bug bites, the effects are permanent. I, too, plan on upgrading to General in the near future. For now, however, my new no-code Tech license will enable me to get started in this great hobby.

My advice for anyone interested in becoming a no-code Tech is to ignore the disgruntled old-timers. We are not "glorified CBers." Good luck to anyone who will be taking the test. Have confidence in yourself. You can do it. I did!

Dorian Blasdell N7PCT, Grants Pass OR In February 1990 I wrote you a letter saying that I couldn't find out where to take the ham radio exams. I believe you printed it in the July 1990 issue.

Here is a progress report. In February 1990 I went to Radio Shack and asked if they knew where the license exams were taking place. They did! I took the Novice, CW, and written exams that month and passed. Then in May 1990 I passed the Technician exam. When December 1990 rolled around, I passed the General and Advanced CW and written exams. Finally in May 1991 I passed the Amateur Extra CW and written exams. I am now 18 years old. Ham radio is lots of fun.

Dorian N7PCT—yes we did print your letter in the July 1990 issue. Thanks for a fine progress report! . . Linda KA1UKM

Ervin L. Sly W6TKJ, Nipomo CA I fully agree with your statements of last month on the crowded 2 meter band. Just moved from the Los Angeles area and my transceiver would scan all day long and not hear a signal. Once in a while I'd hear someone on the way to work or from work, but the rest of the day—nothing. Simplex? Forget it! Find it even worse here. Also on camping trips I can get into many repeaters but there's never anyone listening. Where do they come up with crowded conditions on 2 meters?

Sure enjoy your ranting and raving.

Gerardo O. Lopez Meza XE1UQL, Veracruz, Mexico Radio communications has been the most important activity of my free time. Unfortunately, I found out about it when I was too old to direct my professional advantages over the area. Anyway, I enjoy it deeply, and I understand that every one of us must increase the interest of the people about the many different things you can do in radio.

Three years after I looked for someone to teach me Morse code, I got my license, then I discovered that almost no one uses it regularly; the amateurs prefer voice 10 to 1. The problem—I think—is that some people use the inexpensive ham bands for business, so the government tests the neophyte's interest by means of the code examination.

There are many repeaters and radio amateurs in Mexico and all Spanish America, and they are always happy to answer every QSO received. In Veracruz we love to talk with other persons from far countries.

I want to express to you my desire for people to use more the 10 meter band and to learn to make QSOs in Spanish. You are losing half of America without this language.

Jeffrey Miller KB2FBI, Austin TX Good issue, the June *73*. You waxed quite eloquent this month. It will take several visits to the euphamism *(sic)* to read it all. Nonetheless, right on the mark about standing around watching the foreigners invent everything new and useful, while the useless simply complain about the new Techies. How about a new bumper sticker? You could make hundreds! "I'll give up CW when they pry my cold, dead hands from my brass key!"

Jim Farago, Minneapolis MN Per the June issue, page 76 on "rigs for kids": In your editorial you talk about how various parts from TV sets could be used to make no-cost QRP rigs and such. I have 40 new B/W picture tubes, 9" through 24", 15 good used ones 4" through 21", plus a few hundred TV tubes, replacement TV antennas, line cords, deflection yokes, etc., all of which I would give away to any interested individual, club, or organization. Schematics, too.

I am not looking for a tax write-off or a trash can—I just hope I can give these items to someone interested. Half of these sets are tube-type and half are transistorized. Brands from A to Z. The TV shops I used to work in are all closed now, so they are no help.

I do not want to put these items out with the trash to end up polluting a landfill.

It was good to speak to you at last November's Hamfest at Hennipin Technical Center, even though you were *much* too busy for any lengthy conversation.

Anyone interested in these parts can contact Jim Farago at 4017 42 Ave. So., Minneapolis MN 55406. PLEASE enclose an SASE. . . . Linda KA1UKM

Tom Rehnert N5PLX, Socorro NM Several years ago I got some mail from you hawking your magazine. I was already familiar with it and planning on someday getting a subscription. What struck me about the mail was that it contained a letter from you that was something like 13 pages long. I thought to myself that this guy must have some great large ego to think I'd read all this. It convinced me to get a subscription. I did read it all. I've been getting a big kick out of your editorials ever since. The magazine is the most fun to read and I always look forward to it.

Charles Holm KB7HUW, Spokane WA I am a Novice operator and enjoy your magazine very much. Your new magazine, *Radio Fun*, looks interesting, and I will be subscribing. Its introduction at this time, now that newcomers can get a license without knowing the code, will certainly help the new operators along, as well as inspire technically inclined people to get a license and join us on the air. You were promoting a no-code license years ago, and predicted its adoption. Again, you were right!

Mike Simmons WB9CWE, Belvidere IL Several months ago, you wrote in a *73* editorial about the hazards of low frequency electromagnetic fields as reported in a very reputable magazine. A few months ago, the XYL of an old acquaintance, Ed Pelc (formerly K9RAX), called us. Grief-stricken, she told us that her husband had been undergoing grueling treatments for leukemia, and she greatly feared for his life. The news had a particularly shocking effect, as Mr. Pelc was a TV repairman; he had spent most of his life surrounded by low level EM radiation in his shop.

As a former quality control engineer, I know that one case is poor proof for anything, but it does make one sit up and take serious notice.

James Moe N6ZOB, Newport Beach CA The April *73* described a DXpedition to Malpelo Island (page 81). These remarkable people operated five radios for about five days and logged 40,000 QSOs.

If they managed to keep all five going for 24 hours/day, this works out to about 66 QSOs/hour per radio. This ought to be considered some sort of a record. It must have been especially tough on a 20 wpm CW operator.

This leaves me wondering—is a 60-second QSO what ham radio is all about?

H.S. Van Winckel VE3FWE, Ontario As a Canadian ham, I have been a long-time fan of yours, having followed your career and agreeing with you on the past, present, and future of amateur radio. Here in Canada, I'm one small voice in the mess that we call ham radio, however I voice my opinions as often as I can. Please keep trying, the Amateur Radio Fraternity needs people like you to remind us of the problems we face. 73

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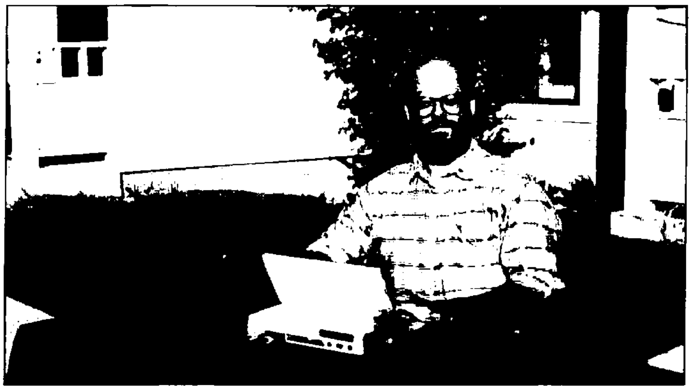

Packet without a TNC? WB2EMS shows you how. . . see page 8.

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Audit Bureau of Circulations (ABC) membership applied for.

Contract: By reading this fine print you are hereby legally obligated to get on the Novice bands and answer a newcomer's CQ. While you're at it, you hereby have one week to say "HI" to a newcomer on your local repeater. Make sure you tell them *73* sent you.

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

. . . de W2NSD/1

Humph, sked time and you're late, as usual. How'm I going to get you to shape up and stop being a wishy-washy wimp? And don't try and put on that "sensitive" act with me, I know you too well.

What in heck has happened to you? When you were a kid you had a sense of adventure. You were willing to be a pioneer. Some pioneer you are now! You don't even see the new movies before Ebert tells you whether you're going to like 'em or not. Pioneer? Pfagh! No, most of you've turned into milquetoasts.

Here you are with the greatest opportunity to pioneer in the history of the hobby. So what are you doing, endlessly gabbing on 2m through repeaters or blathering and kvetching about the mess KV4FZ and K1MAN have made on the low bands?

Are you even on packet yet? Or RTTY? The Japanese are busy discovering ways to squeeze high definition TV (HDTV) into narrower bandwidths. They've just announced a new digital audio format, the mini-disc (MD), which crams 74 minutes of digital sound on a 2.5" disc.

Old-timers will remember the '20s and '30s when Germany had the edge on high technology. German cameras, radios and scientific instruments were the best. Then they got involved with Hitler and screwed up. Through the '40s to the '60s America was way out ahead in almost every technology. The world bought Hallicrafters radios, Kodak cameras and General Radio instruments.

Then Japan discovered Ed Demming and the odd concept that quality really does count. Now we're all buying Japanese cameras, radios and scientific instruments. We're also, in case you haven't noticed, seeing Japanese pioneers skiing down Mt. Everest, crossing the Antarctic on skis, and inventing circles around us in one scientific field after another.

So here you are in amateur radio, firmly stuck in the past, all emotionally worked up over CW, a sad remnant of the '30s. I'll bet 50% of you aren't aware that CW is every bit as important to us today as preserving other antique modes such as AM and spark. Yes, I know, most of the "Spark Forever" crew have their Silent Key awards now and are grumpily moldering. Well, they gave up with the same grace with which our CW-forever brethren are folding their hands . . . buoyed on by the enthusiastic support of the Antique Radio Relay League. Radio *relay*? Har-de-har. Talk about a monument to the past! And let's not even talk about the hoary old goats you've repeatedly elected to help keep amateur radio an archeological resource.

But is amateur radio supposed to be using the incredibly valuable public airwaves as a monument to the past? Aren't we supposed to be experimenting? To be inventing? To be pioneering? Isn't there something in our charter about that? You bet your sweet bippy there is!

So while hordes of you are trying to resuscitate dying technologies such as AM and CW from the dim past, who have we got out there taking advantage of the technological explosion? Certainly not many here in America.

When I speak at hamfests I get blank stares when I bring up new technologies which have been written about recently in *Newsweek* and *Time*. A recent *Forbes* article put our situation into perspective. Today's technology is heading toward the microwaves, where there are more frequencies . . . the frequencies it's going to take to deal with HDTV, personal communicators which handle fax, messaging, and even graphics, computer networking, etc.

So here we are with 500 MHz up there at 10,000–10,500 MHz, with maybe 10 hams in the country using the band. Maybe less. Even if we use today's technology we can get our voice channels down to 5 kHz, which would give us 100,000 channels. Hey, we could all have our own repeater channels and never have to bother talking with anyone else again!

But, as these channels turn from solid gold to platinum, and the commercial demand escalates, unless we're up there doing something of value with 'em, they're going to go. I realize that this is a matter of little moment to most hams. I just don't understand how we ever got amateur radio off 600 meters and up to 160 meters a few generations ago.

That was back when Americans were pioneers. Back when we were eagerly exploring new technologies. Back when Americans were exploring the world. Back when we had some guts. Old-timers will remember Lowell Thomas, Frank Buck, Osa and Martin Johnson, Amelia Earhart, Frank Hawkes, Admiral Byrd.

Old-time hams will remember Copthorne McDonald (SSTV), W2GDG (NBFM), W2BFD (RTTY), W1FZJ (moonbounce and parametric amplifiers). These chaps didn't invent and pioneer to be good guys and save our hobby; they did it because they were having fun. I knew 'em all well. So what's happened to our country that we've stopped having fun with technology? These days 99.9% of us are appliance jockeys.

No, it isn't age. Sam Harris W1FZJ/KP4 was busy pioneering until the day he died. So was John Williams W2BFD. I think I could make a good case for old Doc Spock being at the bottom of this softening of America.

Yes, of course I have a solution. But it isn't one you're going to like. The solution lies in our youngsters. Perhaps we can sneak into our schools and start countering the general concept that technology is bad. Maybe we can get the kids interested in the fun we have to offer . . . not in rag-chewing endlessly, but in experimenting . . . in pioneering new communications.

The food is there on the table, with fascinating stuff from AEA and other ham maufacturers. The question is, how can we get today's hams, starved as they are for excitement and making up for it by making a shambles of our bands, to reach out and even taste the banquet? Please advise. It's out there, waiting. It isn't expensive, but it does mean having to learn . . . and to *dare*.

220 Lives!

A reader, who's in the communications business, advises that while we American hams may not be doing much with 220, there is a brisk business going on just to our south. The drug business in Colombia is apparently delighted with the 220 band and busy buying portable repeaters, HTs with scramblers in hundred lots, mobile transceivers, $15,000 monitors, amplifiers, antennas, night vision equipment, and so on. Hey, they've got to get that cocaine up here for our crack houses, right?

A good friend who ran a ham store in Boston said he often had Hispanic men come into his store with huge rolls of money wanting to buy 144 and 220 MHz repeaters and HTs for cash. Maybe the ham equipment business isn't as badly off as I thought.

Drug dealers make so much money on each delivery that they can afford to buy a repeater and HTs and throw them away after one use. I wonder where the Colombian surplus stores are. There may be some great buys.

U.S. vs. Japan

In case there's a question in your mind about what our new no-code license can do for us, let's just look and see what's happened in Japan, where they've had such a license for years. The May issue of *CQ Ham Radio*, *QST*'s Japanese equivalent, was the usual 586-page phone-book-sized magazine.

Yes, I've been endlessly hearing that unless we keep out the riffraff, we'll end up with one huge CB mess here in America. Well, for more than 20 years we've kept our barriers up to discourage the unwashed hordes, yet when I listen to 20m I hear worse garbage these days than I've heard on CB in years.

So how have the Japanese fared with their no-code licensing? I think we can get a good indication just by looking at their ham magazines . . . which are all monsters compared to the anemic ham magazines we have left here.

Looking over the May *CQHR*, the first 270 pages are solid advertising, mostly in four colors. The last 64 pages of the book are also advertising . . . plus many ads in between. They not only have all the ham gear we have available here, they also have a whole bunch of wonderful products that aren't being exported to the U.S. because our market is too small to bother.

After the front of the magazine advertising section they have 24 pages of fundamental antenna information—how they work—how to use a dip meter to tune your antenna—measuring antenna impedance—how to build a simple Z-meter—building simple low- and high-pass filters—building a 40 meter curtain—and a dozen or so more simple antennas. Then comes IC fundamentals and 14 pages of easy IC building projects.

There's a simple three transistor 10m FM rig construction article, a 440 MHz 25 watt amplifier and a good article on using DAT recorders with amateur radio. There are reviews of a computer logging program, a JRC 0.1–30 MHz receiver, an Azden 10m FM transceiver, a couple of new HTs, and the Yaesu FT-1011 transceiver.

Next comes basic transistor theory, more antenna articles, more simple construction projects, a colorful new products section, DXpedition pictures (in color), hamshack photos, satellite news, DX awards and certificates. The hamfest and club activity photo section has 163 full-color group photos. There are activity report sections for every

Continued on page 73

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Ham Physicians Speak Up

"Only a person familiar with both medicine and amateur radio can make this determination correctly," writes Christine Haycock, M.D., WB2YBA, in a letter to fellow physicians published in *New Jersey Medicine*. She is referring, of course, to the telegraphy waiver for handicapped hams. In December 1990 the FCC passed Docket 90-356, exempting handicapped persons from code tests if their physical condition prevents them from learning the code at 13 or 20 wpm. Dr. Haycock notes: "Totally handicapped quadriplegics have mastered these requirements, as well as blind or deaf individuals, and the psychological benefits of this achievement are immeasurable. There are, however, some rare instances where an individual cannot meet this goal, hence the FCC edict."

Morris Soled, M.D., W2NXS advises non-ham colleagues that "Ham radio is a popular hobby among physicians, and you should be able to find a member of your staff to answer further questions before being a 'nice guy' and signing a note you do not understand."

Dr. Edward N. Ludin, M.D., K2UK, president of the Medical Amateur Radio Council, Ltd., MARCO, was also published. He notes that the precise meaning of "severely handicapped individual" is unclear in relation to the Act *[the 1988 Developmental Disabilities Act, 29 USC 706(15)(A)(III)]*, and that the average physician ". . could not be expected to know what effect these disabilities may have on [a person's ability in] learning Morse code." Like Doctors Haycock and Soled, he urges physicians to not sign a certificate of exemption lightly. He says, ". . . please request, from a local amateur operator, preferably another physician, appropriate advice. I hope that other physician hams will let their fellow physicians at the local level know of their availability in this regard." TNX *W5YI Report, Vol. 13, Issue 12.*

A Brave Young Ham

One of the highlights of K6IR's trek to the Dayton Hamvention was meeting Seth XU1SS from Kampuchea. "What a fascinating story of bravery and hardship," K6IR writes us. "Seth's amateur radio operations from the jungles of Kampuchea using the call XU1SS while under enemy gunfire . . . his heroic escape from Kampuchea . . . and his ultimate reunion, after over a decade of separation, with his family in Washington State after the death of his brother . . . all add up to a tale worthy of a suspenseful movie. The enclosed photo of this brave young man *[see Photo A]* who has endured so much belies the tragedies he has endured in his young life. Seth is truly a remarkable young man and an outstanding tribute to our worldwide hobby of amateur radio." TNX Kenneth M. Miller K6IR.

Photo A. Seth XU1SS (left) from Kampuchea and Ken Miller K6IR (right) meet at the Dayton Hamvention.

Mir Wants News!

U5MIR requests packet stations leaving messages on U5MIR-1 to include news—most messages are boring! KP4BJD had the ". . . unique opportunity, the rare pleasure, to QSO in FM voice with cosmonaut Sergey Krikalev U5MIR for about two minutes . . ." last June. He lists four messages from Sergey: 1. He sends to all: Greetings from space! 2. He congratulates the ship crew and NASA for the successful launch of mission STS-40 and the shuttle *Columbia*, and looks forward to making a QSO in FM voice when their footprints overlap. 3. He respectfully requests all the earth packet stations leaving messages on U5MIR to please kindly include news; they need entertainment, and the usual content of the messages they now receive is boring. 4. Sergey will be available on his "free time" for more FM voice QSOs on 145.55 MHz. *Dosvidaniya* to all from space. De KP4BJD @ KP4GE.PR.USA.CARB.

No American Woodpecker

The U.S. Air Force has scrapped its plans for an over-the-horizon backscatter (OTH-B) radar system, according to *Jane's Defense Weekly*. The program has been called the "American Woodpecker" because its Soviet counterpart is known as the "Russian Woodpecker." The interference this system causes in shortwave communications resembles the pecking of a woodpecker.

The American OTH-B would have had a range 10 times greater than that of conventional radar, and served as an early warning system. General Electric was to build four systems spanning the Northeast, West Coast, Alaska, and north-central states. The decision to scrap this project will help alleviate the fear of increased QRM to HF communications on the ham bands. TNX *Westlink Report, No. 602. (The major details of the OTH-B project was reported in "QRX" in the August 1990 issue.)*

No-Code ROs

Where it can legally do so, the FCC is relaxing its rules which require radio officers with Morse code proficiency on board ocean-going vessels. Recently, the Commission amended its rules to permit small passenger ships weighing under 100 gross tons to operate under the general exemption from the manual Morse code radiotelegraph station requirements beyond the current 100 nautical mile limit. TNX *W5YI Report, Vol. 13, Issue 12.*

Poor Man's Packet

A complete software TNC for PC compatibles!

F. Kevin Feeney WB2EMS and Andy Payne N8KEI

Poor Man's Packet (PMP) was conceived in the fall of 1988. Andy Payne N8KEI, an electrical engineering student at Cornell University, wanted to get into packet but a TNC wasn't within his student's budget. He was sure he could write a software TNC for IBM PCs and compatibles. I'd been involved in packet for several years, but I wanted a more compact means of operating portable with my new laptop computer—like a software TNC running on the laptop with a small modem interface. Andy and I ran into each other on the local repeater, met to exhange ideas, and PMP was born.

A regular TNC consists of a dedicated microcomputer, some software in ROM, a simple Bell 202 modem, perhaps an HDLC chip or a Data Carrier Detect (DCD) circuit, and some "glue" chips to tie everything together. Most people then hook up this specialized little microcomputer device to a personal computer of considerably more power and capacity. The processing power of the PC is mostly wasted, used only to loop on a simple terminal program, shuffling keystrokes to the TNC and bytes from the TNC to the screen.

What is PMP?

PMP approaches the task from a different direction, using the PC to do the work of the dedicated microcontroller. The software is on disk instead of in ROM. Hardware HDLC and DCD circuits are nice, but not necessary for simple TNC implementation. The modem is a simple, one-chip, external design that the software accesses via the handshake lines on the printer port. The terminal interface functions are built right into the program, with direct access to the screen and keyboard. Instead of storing operating parameters such as callsign, transmit delays, or number of retrys in a non-volatile memory like a regular TNC, PMP reads them in on startup from a configuration file.

Using this design, you can build a simple, inexpensive packet communications system. PMP won't support multiple connects or act as a black box TNC for use as part of a BBS, but it's good for the usual connections to the local BBS to read and post mail, for getting your feet wet in packet, and for portable or emergency operation. *[Ed. Note: The PMP program is available from the author as well as the 73 BBS at (603) 525-4438.]*

How It Works

To transmit a packet, the software builds the packet up from the entered data. It then commands data bit D1 (pin 3) on the printer port HIGH, turning Q2 on and keying the radio. Then the software begins toggling the D0 bit (pin 2) back and forth, sending the packet "flags" to open up the distant receiver and synchronize the demodulator. After the flags are sent, the software sends the actual data in the packet, then more flags at the end. Finally, the software turns off D1 and the radio unkeys.

Receiving packets is a little more complicated. While the radio is squelched, the Carrier Detect output (CDT—pin 3 of the 3105) is held LOW. The software "watches" this by looking at the printer port BUSY line (pin 11) indicating that packets are presently incoming, which frees the software to handle the keyboard processing, disk operations, and screen updates.

When the radio unsquelches and sufficient audio starts coming into the chip, the CDT line goes HIGH, signalling the software to "drop everything" by disabling interrupts. It starts timing the 1 and 0 transitions coming from the modem on the Receive Data line (RXD—pin 8 of the 3105).

It does this until the radio squelches and the CDT line goes high again, at which point the software translates the data it has just received from NRZI bit flips into ASCII and displays it on the screen. The program then goes on to handle the other tasks that were shut off during the incoming packet.

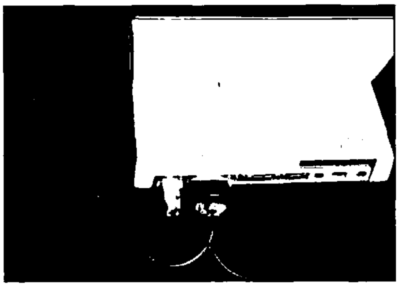

Photo A. Portable packet without a TNC!

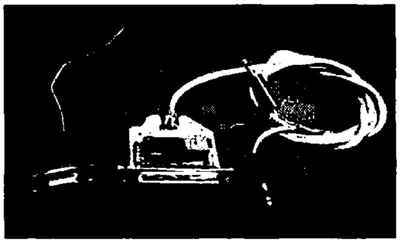

Photo B. The interface installs easily between your computer and radio.

The Modem

While Andy was cooking up the software, I started building modems. I evaluated several of the chips available. The EXAR 2211/2206 are used in several commercial TNCs, but they can be finicky to tune and keep tuned, and I was concerned about temperature swings while portable.

The AMD 7910 World Chip offers several modem frequencies, including some suitable for HF packet, but it's physically large and requires three operating voltages.

Texas Instruments' TCM3105 won out. It has a Bell 202 half duplex modem that requires a minimum of external parts, crystal controlled stability, and low current drain, all in a 16-pin DIP. The final circuit is shown in Figure 1.

Starting in the upper left, U1, a 78L05 miniature voltage regulator drops the incoming voltage to 5 volts for the modem chip. C1 keeps the regulator stable when the power source is more than a few inches away.

Pin 2 is the clock drive output. To generate Bell 202 tones, the TCM3105 requires that an inverted clock be fed into Pin 5. The clock drive from pin 2 is fed into the base of Q1 through R4 to limit the base drive, and the inverted output is taken off the junction of the collector and R3, and fed back into Pin 5.

Pin 3 is the Carrier Detect output from the modem. The TCM3105 senses the audio energy coming into it and raises the line HIGH when the audio is sufficiently strong. Andy's software reads this line via the BUSY line of the printer port (pin 11), and starts trying to decode incoming packets whenever it is HIGH. The chip does not do any filtering or check to see if the incoming signal has the proper tones; it simply reacts to audio level. This means random noise or an unsquelched receiver can trip the line and start the sofware trying to decode. Unlike more complicated circuits with a DCD detector, PMP depends entirely on the radio's squelch to tell when an incoming packet is arriving.

Pin 4 is the receive audio input. C3 provides AC coupling so the internal bias network in the chip isn't dragged down. Initially I had very poor receive results until I figured out I had forgotten this capacitor.

D1 and D2 provide clipping of the signal to protect the modem's input circuit if the audio is

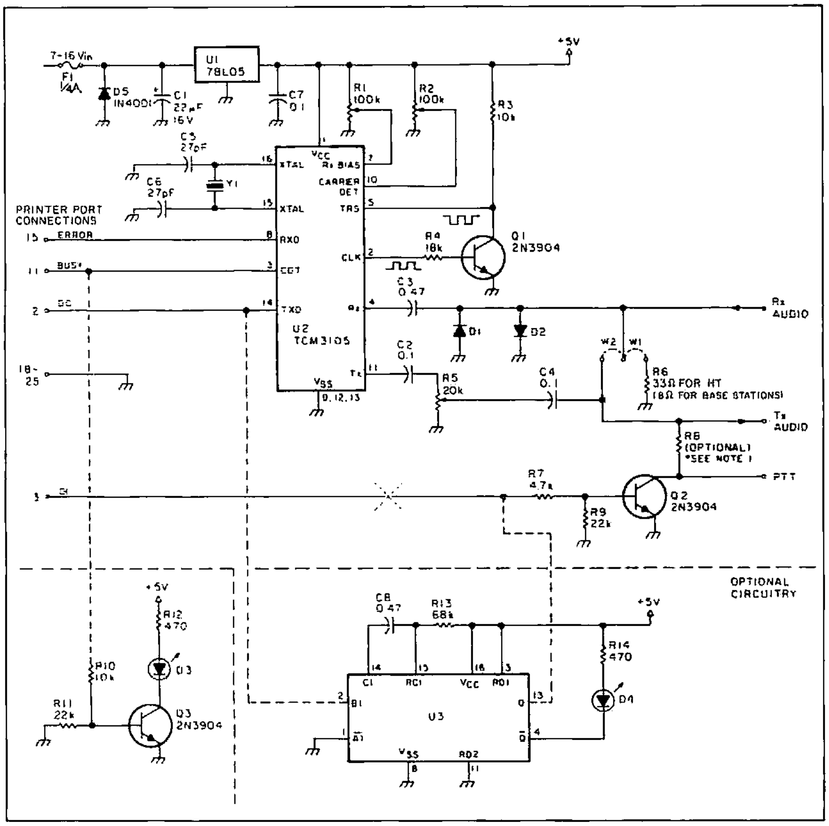

Figure 1. Schematic diagram of the modem interface. The bare bones laptop interface is shown above the dotted line. Use the whole schematic for the home station interface (includes a watchdog timer circuit).

cranked up too high. Even with an HT it's possible to develop enough voltage to damage the chip. The diodes limit the voltage to about 600–700 mV peak. Resistor R6 provides a load for the receiver. Since I generally use my modem with an HT, I put 33 ohms at R6 since that is a good match for the HT's output impedance and takes less power from the rig to drive. If you are operating with a base or mobile radio, you may want to change this to 8 ohms, and make it a 1 watt resistor, in case the audio gets cranked up by accident. This is easy to do when you aren't actually listening to the signal.

Pin 7 is the Receive Bias threshold adjustment. The voltage here determines how the incoming tones are divided into ones and zero. It requires careful adjustment. A 10-turn pot is recommended for fine adjustments.

Pin 8 is the Received Data output from the modem to the computer. It sends the ones and zeros from the modem to the software via the printer ERROR input line (pin 15 of the printer port).

Parts list

U1	78L05	5-volt regulator
U2	TI TCM3105JL	1200 bps half duplex modem chip
U3	74LS123	one-shot mullivibrator
Y1	4.433619 MHz crystal	European colorburst frequency
Q1,Q2,Q3	2N3904	or 2N2222, etc.
D1,D2	1N914 or 1N4148	switching diodes
D3,D4	LEDs	red for D4, green for D3
D5	1N4001 diode	
C1	22 µF, 16V	tantalum capacitor
C2,C4,C7	0.1 µF	
C3	0.47 µF (0.33 to 1 µF can be used)	
C5,C6	20 to 30 pF	
C8	0.47 µF	
R1,R2	100k trimpot	multi-turn
R3,R10	10k	
R4	18k R5	20ktrim pot
R6	33 ohm for HT use	8 ohm, 1 Watt for base/mobile use
R7	4.7k	
R8	4.7k to 12k (10k nomimal)adjust for keying HT (optional)	
R9,R11	22k R12,R14	470 ohms
R13	68k	
F1	¼ amp fuse	

Most parts are readily available, with the exception of the modem chip and crystal. These can be obtained from your local Texas Instruments distributor. F. Kevin Feeney WB2EMS can supply a chip/crystal pair for $24 as well as blank PC boards for $7 each (see author's bio for address). Kits may also be available. Contact the authors for details. The software, including source code, is available from the authors on disk for $10 and from various sites on Internet. You can also download PMP from the *73* BBS at (603) 525-4438. Look under the *73*MAG SIG.

Pin 10 is the Carrier Detect threshold adjustment, similar to pin 7 but not as critical in adjustment.

Pin 11 is the transmit audio output from the modem. C2 provides AC coupling, R5 allows adjustment of the audio level, and C4 breaks the DC path to the transmitter in case it has a DC bias, like the input circuits of many HTs.

Pin 14 is the transmit digital data from the software to the modem. It comes out from the D0 bit (pin 2) on the printer port and causes the modem tone output to switch between 1200 and 2200 Hz with the zeros and ones.

PTT for the modem is arranged by driving the D1 bit of the printer port (pin 3) HIGH. This output drives Q2 through R7, pulling the transistor's output LOW and keying the rig. Q2 can handle about 50 mA. For use with ICOM style HT keying, resistor R8 should be connected between the transmit audio line and the collector of Q2.

For radios with separate PTT lines, R8 should be eliminated. I have found values between 4.7k and 12k to work well at R8. If the resistance is too high, the radio won't key reliably. If it's too low, the transmit audio may be shunted to ground. In using the modem with an ICOM HT, I found that if the transmit gain is set too high, the radio will key as soon as the microphone plug is installed. I believe this is due to the negative-going swings of the audio pulling current from the HT keying circuit and turning it on. I just adjust the transmit gain pot R5 until the radio unkeys. At that level it is far too high for proper modulation anyway.

Assembly and Tuneup

I have built a number of these modems in different configurations. If you are brave of heart and steady of hand, it is possible to cram the entire modem into a DB-25 connector housing, which can then plug directly into the back of a laptop with only a cable to the radio. I've managed it twice, and if you can steal power from the serial port to run it, it makes the sweetest little portable packet setup you ever saw. If you do try it, start with a 16-pin DIP socket and get the smallest pots you can. Mine has a couple of layers of components in one area, separated by tape. Be creative and know it *can* be done.

For those less fanatic builders, the modem can easily be built on a 1.6" x 2" piece of vectorboard. You can either attach the board directly to the DB-25 connector by wedging the board between the rows of pins and applying some epoxy (after making the required connections!), or you can separate the board and the connector with a short, 5-wire cable. Parts layout on the modem is not critical, except to keep the connections around the crystal short. I have built 10 modems with six different layouts from "crammed" to "wide open spaces," and none has failed to work.

A PC board is available to help in assembly (see the Parts List and Figures 2 and 3). Two versions of the modem interface are shown. The smaller board in Figure 2 is designed for portable laptop operation. While the larger circuit shown in Figure 3 can be used for portable laptop use, it is best used for a home computer installation where you plan to leave the modem interface hooked up for long periods. The home interface draws more current and needs a separate power supply (either from a 9-volt battery or DC wall supply).

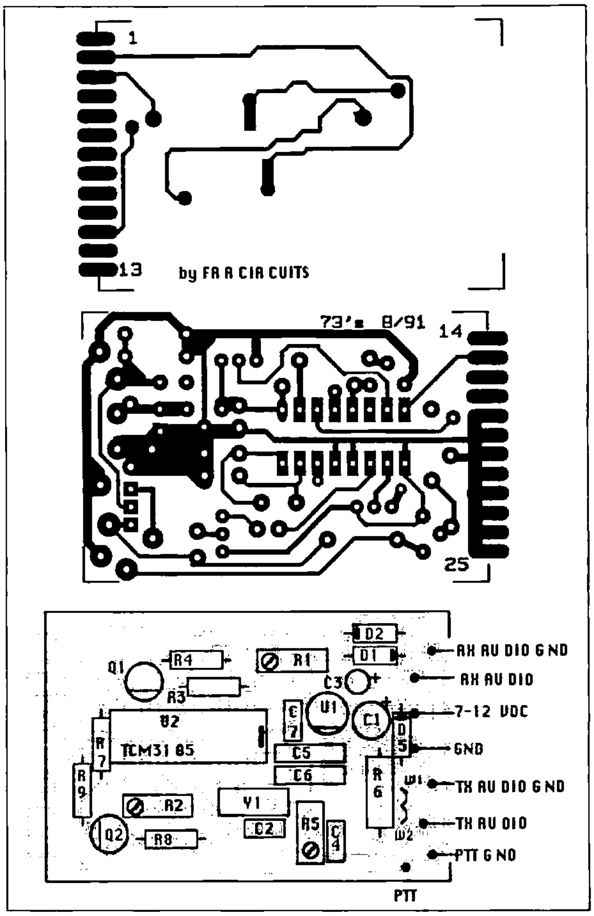

Figure 2. PC board foil pattern for the laptop interface. (a) Top layer (solder the top pads as well as on the bottom). (b) Bottom layer. (c) Parts placement.

Why two versions of the modem? In the interest of portability, the laptop interface lacks a time-out circuit to make it as small as possible. It is designed to be hooked up only when you want to operate packet. The problem is that when you exit the PMP program (or if the computer resets itself), the laptop interface may key down your transmitter continuously (a detailed explanation of this appears in the "Enhancing PMP" section of this article). This is not a problem when you are actually running the PMP program, however. The larger home station interface (Figure 3) solves this with a watchdog circuit and can be left hooked up to your parallel port indefinitely. Just remember: **When using the scaled-down laptop interface, always disconnect it from your computer when you're done operating packet!**

To assemble the laptop interface, just slide the PC board between the rear pins of the DB-25 connector and solder in place. Install the components and make up cables to run to your radio. The interface can be powered by running a cable over to the serial port.(See Figure 3 for serial port connection).

The laptop interface board will fit into the Radio Shack transmitter case (RS # 270-293). The end panel of the case should be notched out to mount the DB-25 connector. Use washers to space the connector away from the end panel far enough so that the PC board just fits into the compartment. This "transmitter case" has an internal space specifically designed for an optional 9-volt battery as well.

The home station modem interface requires a larger case. Also you will have to wire up a cable to run over to your computer's parallel port. See Figure 3 for details.

Checkout and Adjustments

After construction is completed, apply power to the modem with the TCM3105 chip unsocketed. You should have 5 volts on pin 1. If not, check the regulator chip U1 and associated wiring. Check pin 7 and adjust R1 initially for a voltage of 2.26 VDC. Check pin 10 and adjust R2 for 2.5 volts. Next, remove the power and insert U2. Connect the modem to the computer and the receive audio line to the radio. Don't connect the transmit line at this point. Boot up the computer, load the disk, and type PMP to start the program. When the title screen appears, press any key to go to the operating screen.

To adjust the Carrier Detect threshold pot, R2, connect the receiver and squelch the radio. Turn R2 until the RX indicator in the lower right corner of the screen disappears. The RX indicator is tied to the operation of the CDT line. It indicates when PMP starts to attempt decoding packets. Now unsquelch the radio and turn up the volume until it reappears. Resquelch the radio and be sure it disappears immediately. The object is to have the CDT line quickly and cleanly follow the operation of the radio's squelch. If R2 is set too close to the threshold, the CDT line will not follow the closing of the radio's squelch quickly enough. If the RX symbol on the screen never goes away, make sure you have the modem plugged securely onto the printer port, that it has power applied, and that pin 3 of the modem chip is wired correctly to pin 11 on the printer port connector.

To set the RX bias, set R1 for a reading of 2.26 volts at pin 7 of U2; that is a good starting value. When you begin listening to actual packets, if they are not being printed on the screen, you can rock R1 back and forth until you start copying packets. It helps to have a nearby friend send a bunch of beacons or unprotocoled packets for this. Andy has written a supplementary program called PMPTEST that simplifies this process by giving an indication of how closely adjusted R1 is. Using the program and listening to on-the-air packets will get R1 dialed in pretty quickly.

To adjust the transmit audio, send packets while listening on a second receiver. Adjust R5 until the audio stops increasing, then back it off until the audio just starts to diminish. This should put you near the edge of limiting and give you the cleanest audio. The adjustment isn't very critical, but if you are having problems communicating with a particular station, you may need to rock it a little near that threshold of limiting to account for the "twist" between the 1200 and 2200 Hz tones.

Easy Operation

To set up PMP for operation, you first have to edit the configuration file. This is where you tell PMP your callsign, and other information, such as how long you need to wait for your transmitter to key up—the same information you have to provide any TNC before operation. The default information will work for most users, needing only the correct callsign entered. This can be done with any ASCII text editor. The software supplied on the disk contains a program to build your configuration file automatically.

PMP is simple to use. Just hook up the cables to your radio, and plug the interface into your computer's parallel port. Hook up to the serial port for power if you aren't using a 9-volt battery (only for the laptop interface version). Insert your PMP disk and type PMP at the prompt. Hit enter after you see the opening screen and you're ready to go! Andy has simplified a lot of the commands to be single keystrokes. For instance Alt-C commands a connect, Alt-D a disconnect and Alt-H displays the help screen. Hit Alt-L to start capturing a text file. Hit Alt-L again whenever you want to close the capture file. See Table 2 for a complete list of commands. ASCII uploads and downloads are possible, and the scrollback buffer is as large as available memory. One operator in our area lets PMP monitor all day long, and simply walks back through the day's packets a screen at a time to view messages flowing in and out of the area BBS.

Table 2. PMP Commands

Alt-C	Connect
Alt-B	Send Beacon
Alt-D	Disconnect
Alt-H	Show the help screen
Alt-J	Copy a snapshot of the current screen data to a file
Alt-L	Download/Capture a text file
Alt-N	Show a list of nodes recently heard
Alt-P	Pause the screen
Alt-S	Show the system status
Alt-U	Upload a text file from disk
Alt-W	Write the scrollback buffer to disk
Alt-X	Exit PMP
F1-F4	User definable macros
Up/Down	Scrollback a line at a time
PgUp/PgDn	Scrollback a page at a time

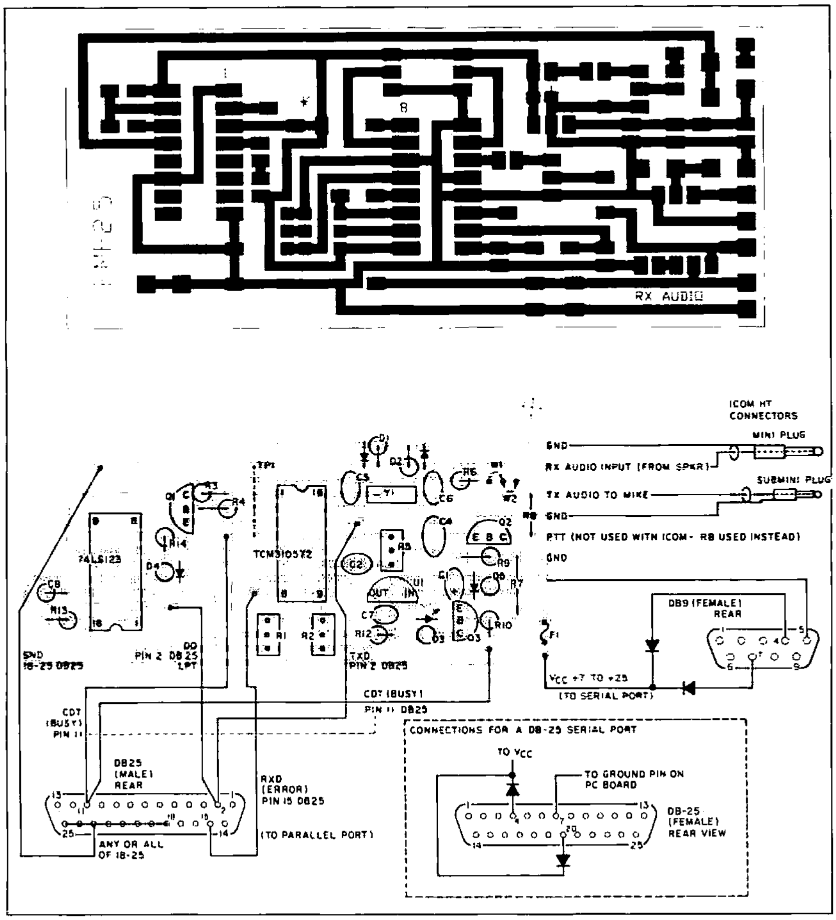

Figure 3. (a) PC board foil pattern for the home station interface with watchdog timer circuit. (b) Parts placement.

Possible Problems

Because of its simplicity, PMP is not quite as foolproof as a full-featured TNC. One potential problem area would be a slow squelch on a radio. Since PMP does not use a DCD (Data Carrier Detect) circuit, it depends on the squelch in conjunction with the CDT line from the modem to tell it when a packet starts and ends. A slow squelch opening may clip the packet header with the callsign information off, rendering the packet unusable. A slow closing squelch is less of a problem because the software can tell by the ending flags where the packet terminated, but the computer remains frozen from responding to the keyboard or displaying the packet until the squelch closes and the CDT line goes low again. The rule of thumb is to put the squelch close to the threshold of opening to help the speed.

The second potential problem is related—performance on a very busy channel. Because of the simplicity of the hardware, the software is very heavily tasked during receive periods, literally timing and counting the bit flips from the modem. Allowing a keyboard interrupt or other distraction during this period would cause the system to lose track of the packet it was in the process of receiving, so all the interrupts are masked off when CDT is high.

On a very busy channel, CDT will go high with each packet heard, and if there is near continuous traffic this can effectively lock the user out of the keyboard! (This will also happen if the radio becomes unsquelched accidentally, or if the modem falls off the parallel port, allowing the CDT pin to float HIGH.) In urban areas it can make things difficult. The only solution is to wait until the channel activity calms down, or pick a less busy frequency.

PMP has been checked out on a fair sample of IBM PCs and compatibles. It does require pretty good compatibility with the IBM standard. Some problems have been reported with machines that have known IBM compatibility problems, such as the ATT PC6300. A partial list of machines it is known to work on includes an IBM PC/XT, Toshiba T1000, Leading Edge Model D, Tandy 1100FD, WYSE PC286, and various 286 and 386 machines using Award BIOS. It even runs in a window under Desqview on my 386 machine.

Enhancing PMP

Figure 1 shows the schematic for the simplest version (the laptop interface) of the modem (the circuit above the dotted line), designed to be hung on the back of a laptop. However, there are a few enhancements below the dotted line that might be of interest (the home station interface).

The radio PTT line is keyed by a signal from the software via the D1 data line on the parallel port; but D1 is only under control when PMP is actually running. If you want to leave the modem and radio connected at all times, you may find that D1 is turned on by other programs, or following a reboot, which inadvertantly keys the transmitter. At times, you may also wish to leave the computer unattended, perhaps to monitor traffic on a channel. An accidental reboot from a power loss could leave D1 in an unknown state and the transmitter keyed.

To address this, U3 was added to form a time-out timer. U3 is a 74LS123 one-shot multivibrator with edge-triggered inputs, whose output circuit is used to drive Q2 instead of letting PMP control it directly. The output of the one-shot stays LOW until pin 2 goes HIGH, then it raises its Q output, turning on transistor Q2. The output only stays HIGH for about 10 milliseconds, unless pin 2 goes LOW and then HIGH again. Pin 2 is connected to the tranmit data from the PMP program. When PMP is running and sending data to be transmitted, the data line connected to pin 2 is toggling at about a 600 Hz rate. Each transition resets the time-out on the one-shot, keeping its output HIGH and the transmitter continuously keyed as long as data is being sent. When the flow of data stops, pin 2 stops changing state, and the one-shot times out 10 milliseconds later, unkeying the transmitter.

If the program locks up, or the computer resets, or if another program is being run, D1 will likely sit at either a one or a zero, but it probably won't be toggling at 600 Hz. So, the transmitter will only burp for 10 milliseconds if D1 goes HIGH, and then it will stay off. D4 and R14 use the /Q output of the one-shot to provide an optional keying indicator.

The circuitry associated with Q3 and D3 also provides for a receive LED. The base of Q3 is tied to the Carrier Detect (CDT) line of the modem chip, and when it goes HIGH indicating received audio, Q3 turns on, causing D3 to light. I use a green LED for D3, and a red LED for D4.

For portable operation, the bare bones modem has a low enough current drain that you may be able to steal enough power from your computer's serial port to run it (or use a 9-volt battery). The PMP configuration file has provisions that allow you to command the handshake lines of the serial port to a desired state. In my case, I command both the hardware handshake lines HIGH and OR them through a pair of diodes to provide about 7 volts at 12 mA, just enough to give me 5 volts out of the regulator. The voltage and current available from the CTS and DTR lines varies from machine to machine, but if you can do it, it reduces the entire packet setup to a computer, a cable and a radio. I have not seen anything simpler for portable packet! Because it is so simple to drag around compared to other packet systems, I find myself running packet from all kinds of locations—the park at lunchtime, a weekend campsite, or even the laundromat!

Poor Man's Packet has achieved both of the goals we set out to accomplish. Andy now has an inexpensive system to allow him to join local packet operations, and I have an easy-to-use packet system for portable operation.

Contact F. Kevin Feeney WB2EMS at 468 Hines Road, Newfield NY 14867. Please enclose an SASE. You can also reach him at kfeeney@helios.tn.cornell.edu. You may reach Andy Payne N8KEI, the software designer, at payne@theory.tc.cornell.edu.

73 Review *by Marc Stern WA1R*

Pkt-GOLD Multimode

InterFlex Systems Design Corp.
P.O. Box 6418
Laguna Niguel CA 92607-6418
(714) 496-6639
Price Class: $60

Your software window into the world of digital communications!

I like new software, especially things I can use with my Heathkit HK-232 MBX multimode controller, a PK-232 clone.

Pkt-GOLD Multimode is a program that turned out to be one of the best implementations of multimode controller software that I have seen. In my opinion, the program does a great many things right, or better-than-right, and it all adds up to quite a nice piece of work by the developers at InterFlex Systems.

Installation

For starters, loading and setting up the program on a hard disk is easy. All you do is put the disk into drive A, and type "INSTALL"; the program does the rest. After you answer several questions about such things as baud rate, communications port, video adapter and the like, as well as filling in your call, you are ready to go by typing "PKTGOLD" at the system prompt.

Pkt-GOLD Multimode takes full advantage of AEA's "host" mode—perhaps the most robust implementation of "host" mode on the market. It allows you to keep the memory backup batteries in place during power-up. AEA's own software indicates that you have to pull out the batteries to prevent software hanging up, but Pkt-GOLD Multimode lets you leave the batteries in place. Pkt-GOLD Multimode emulates the PK-232's architecture in software, which makes your PC's RAM look like a multimode controller. To the controller, it doesn't make a bit of difference where it gets its information from, whether the information comes from its own buffers or your PC's RAM. Pkt-GOLD Multimode attempts to retain any text that might be in any of your controller's buffers. If it does not find text, after checking several times in an effort to avoid a RESET command, it then has to load the buffers with program and textual information and this takes time.

I found that InterFlex's advice was well-taken as I tried using my controller both without and with batteries. Without batteries, and if the TNC was turned off, the initialization process took the better part of a minute. With the batteries, the initialization took about five seconds because the controller was set up and ready to go with parameters that I had already entered.

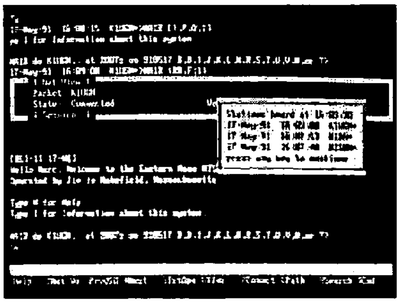

Photo A. While you're connected to another station, Pkt-GOLD's versatile features allow you to monitor all of the channel activity. All activity is displayed at the top of the screen (Net View); your connect session is displayed at the bottom portion (Session). Pop-up screens are available at any time. For example, pressing <ALT> F2 gives you the current MHEARD list.

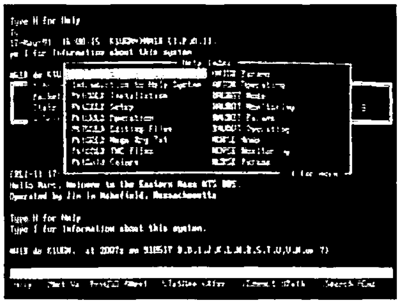

Photo B. The help screen is available at any time as a pop-up menu.

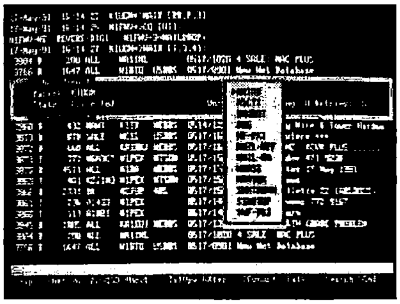

Photo C. Pressing function key F10 allows you to quickly change modes.

The bottom line is to put the batteries back in the TNC. This saves Maildrop messages in case of power loss, and offers some other advantages as well (like not losing your callsign, alias, and other settings if there is a brief power loss, or if you turn off your TNC and turn it back on). With the batteries installed, Pkt-GOLD Multimode zipped through the initialization. A pop-up window displayed the parameters that Pkt-GOLD Multimode was loading into memory from the default ASCII text file, called "Startup.TNC." If the Startup.TNC file is edited to bare bones start-up parameters, the initialization is virtually instant.

A Versatile Program

Pkt-GOLD Multimode's development team, Lynn Taylor WB6UUT and Jeff Towle WA4EGT, have put lots of nice things into their software.

For starters, the user interface is clean and intuitive. There's a brief listing of the function keys at the bottom of the screen. The ALT key changes the functionality of those keys. The user interface also offers a split screen that lets you monitor what is going on with sessions other than your own, as well as of your own. It's like having an eye on the frequency you are using, as well as on the station you are trying to contact.

It's easy to see that this software is powerful. For example, when I was using Pkt-GOLD Multimode for multi-connects, I found that when I pressed the CTRL key on my PC, I saw a number of channels indicated at the bottom. In several of those channels I saw the stations that I was trying to contact. When I was multi-connecting, the program latched onto the station with which I was trying to connect and assigned It a specific memory location, or "channel." Also, if you are doing a multi-connect, a few keystrokes will put these stations into one or more conferences, which is great for emergency situations or general round-table discussions.

Pkt-GOLD Multimode is loaded with utilities. I found that not only could I log onto my favorite bulletin board and my home BBS, but I could also log onto other stations at the same time. All I did was type in the callsign of the station I wanted to connect to, hit the F7 func-

RF POWER AMPLIFIERS

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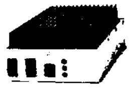
Model	Pin (W)	Pout (W)	Ic (A)	Gain/NF (dB) (dB)	(13.6 V) Type
50 MHz					
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	-/-	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	-/-	Repeater
0550G	10	400	60	15/0.6	HPA
0550RH	10	400	60	-/-	Repeater HPA
0552G	25-40	400	55	15/0.6	HPA
0552RH	25-40	400	55	-/-	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	-/-	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	-/-	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	-/-	Repeater
1450G	10	400	54	15/0.6	HPA
1450RH	10	400	54	-/-	Repeater HPA
1452G	25	400	50	15/0.6	HPA
1452RH	25	400	50	-/-	Repeater HPA
1454G	50-100	400	45	15/0.6	HPA
1454RH	50-100	400	45	-/-	Repeater HPA
220 MHz					
2210G	10	130	20	12/0.7	Standard
2210R	10	130	19	-/-	Repeater
2212G	30	130	16	12/0.7	Standard
2212R	30	130	15	-/-	Repeater
2250G	10	220	42	14/0.7	HPA
2250RH	10	280	45	-/-	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	280	40	-/-	Repeater HPA
440 MHz					
4410G	10	100	19	10/1.1	Standard
4410R	10	100	18	-/-	Repeater
4412G	20-30	100	19	10/1.1	Standard
4412R	20-30	100	18	-/-	Repeater
4450G	10	175	34	12/1.1	HPA
4450RE	10	175	34	-/-	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	-/-	Repeater HPA



MODEL 1410G

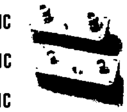
MODEL 1450G

All amplifiers (non-rptr) are linear, all-mode with telly automatic T/R switching and PTT capability. The receive preamps use GaAs FET devices rated at .5 dB NF with +18 dBm 3rd order IP. LPA, Standard and HPA amps are intermittent duty design suitable for base and mobile operation. Repeater amps are continuous duty, class C.

Amplifier capabilities: High-power, narrow or wide-band; 100-200 MHz, 225-400 MHz, 1-2 GHz. Military (28V), Commercial, etc. – consult factory. A complete line of Rx preamps also available.

RX Preamplifiers

Band	Model	NF (dB)	Gain (dB)	Connector
50 MHz	0520B	.5	25	BNC
50 MHz	0520N	.5	25	H
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	BNC
440 MHz	4420N	.5	18	N



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CIRCLE 232 ON READER SERVICE CARD

tion key, and then switch sessions with the F4 function key. Each session would alert me if there was mail or traffic waiting with a flashing prompt on the graphics screen. I was then able to personalize things by going back to each session with the F4 function key and, by using ALT-N (name) keys, type In the operator's name which then appeared next to the callsign on each session screen.

Using the "next" key [F4], I was able to cycle through the sessions easily. Note that each session was individual and any text I typed was used only by the particular session I had attached to. Pkt-GOLD Multimode also has "cut and paste" features that allow you to transfer text to another station. For example, I cut text from an AMTOR session, and sent it to the local packet BBS after editing it using the clipboard editor. Also, printing to a printer or file is easy using [Alt-P]. Printing can commence from the beginning of the screen buffer (which can be as much as 300K), or you can just print new text.

The program also supports saving session text on a callsign-by-callsign basis. You tag certain sessions as "important," and every time that station connects, text is saved/appended to a file with the callsign as the file name. These are certainly useful features for emergencies or situations requiring backup documentation.

There is no special screen to go to, but you can enter a full screen parameter editor if you wish. Changing one or a few parameters is done easily by typing the parameter and value, and using the CMD key [F10]. Basically, you use the [Enter] key to send things THROUGH the controller over to the other station, and the [F10] key to send things TO your controller, such as parameter changes or new settings.

Pkt-GOLD Multimode also understands how to use NET/ROM for hopping from node to node. Connecting to a node and requesting a circuit to the next node takes time. Pkt-GOLD Multimode does the waiting and automatically issues the subsequent "connect" requests for you. You just type something like this: CNODE1 | NODE2 | NODE3 | W2ABC and Pkt-GOLD Multimode handles all the interim node connects, getting you to W2ABC. As it progresses through the node system, each successful connect results in a CW message and a pop-up screen telling you of the progress through the node system.

You can also set up "quick connects" with these multi-hop "path" statements and simply hit the [F7] connect key, highlight the target station, such as "W2ABC," and the program does the rest.

An interesting feature of NET/ROM is that you may have multiple connects to a single node by using its node alias. If you connect to the node using the station callsign, NET/ROM allows only a single connect. However, if you connect to a node using its alias (e.g. "GR-BOX" instead of "WA1R-2") NET/ROM will allow up to 15 multiple connects using the "alias-n," where "n" can be up to 15. Pkt-GOLD Multimode understands this, and allows you to use the same set of NET/ROM nodes to establish many sessions. It automatically assigns unique sessions with the entry node by assigning different SSIDs, the number after the "alias" name.

Multiple Features

Perhaps the neatest thing I found is Pkt-GOLD's ability to implement all the modes of the controller.

Pkt-GOLD Multimode takes advantage of the ROM that is already in your controller. With Pkt-GOLD Multimode, you can use the same friendly program features on all of the other modes available. If you have a PK-232, you can use AMTOR, NAVTEX, RTTY, Morse, TDM (Time Domain Multiplexing, a new PK-232 mode in which several signals are able to use one frequency by digitally shifting their timing slightly), packet, and the PK-232's patented SIAM mode. Changing modes is a snap.

Pkt-GOLD Multimode also offers protocol file exchanges for error-free transmission of any file, while allowing keyboard-to-keyboard conversation on the same channel, and of other multiple connects, all at the same time. You can get remote user directories and, while transferring a file, the program shows the remaining time and the effective baud rate of the transmission to other stations requesting files. It also provides file transfer statistics to these other stations, estimating when the file transfer will be finished.

For those with PK-88 controllers, Pkt-GOLD Multimode offers all of the powerful features that it does on the PK-232 (for packet mode). Briefly, some of the other features are "Brag" file support for longer descriptive messages, and [Alt-0..9] keys for one-line messages, both supporting macros such as "?callsign" to fill in the other station's callsign, or "?name" to fill in the remote user name, to make messages appear to be personalized.

Well Worth the Money

To say that I like this program is putting it a little mildly. I tested Pkt-GOLD on my PC clone (EGA monitor, 640K of RAM, 80286 CPU, hard disk). It also supports VGA and other enhanced video display cards. The program runs flawlessly at the highest terminal baud rates of 9600 for the PK-232 and 19200 baud on the PK-88. It has an integrated set-up area, accessed with the [Alt-S] key combination. This is where you enter quick connects, station information, and set many of the program refinements like 25/43/50 line screen mode color settings, size of the NetView screen, pop-up window time, Morse code announcement speed, file paths, and the like.

Pkt-GOLD features pop-up displays and menus galore. The documentation is clearly written and leads you quickly through the features of the program. In addition to the printed book, you get a complete online help system that is context-sensitive and hypertext.

You can learn about operating modes, parameter settings, frequencies, even how to tune up the controller and radio for maximum performance, by perusing this multi-page cross-referenced help system.

Overall, if you are looking for a reliable, solid system, I would say Pkt-GOLD Multimode is more than worth the price, much more than worth it!

Low Cost Discone Antenna

Wideband coverage from 144 to 1296 MHz.

by Phil Salas AD5X

I needed an antenna that would satisfy a lot of needs. After purchasing an ICOM R-7000 receiver (25–2000 MHz) for some experimental work in the UHF and low microwave ham bands, I wanted a good broadband antenna that I could easily mount in my attic and that would provide coverage of the 144, 220, 450, 903, and 1296 MHz ham bands. I also needed this antenna to provide a good match so that it could be used for transmitting within these ham bands as well. Though this sounds like I'm asking a lot, there is a broadband antenna that can satisfy these needs: the discone antenna.

The Discone Antenna

When properly designed, a discone antenna provides decade (10:1) frequency coverage with a good match (see Figure 1). The discone consists of a disk (the driven element) mounted over a conical ground plane. The cone is an equilateral triangle whose dimensions are a quarter wavelength at the lowest operating frequency. The disk (driven element) has a diameter of 70% of a quarter wavelength at the lowest operating frequency. The disk should be very close to the apex of the cone; the recommended spacing is from 10–30% of the diameter of the apex of the cone.

The trick is to be able to easily realize the cone and disk as well as provide a solid insulated support for the disk and a sound mounting method for the overall antenna. Also, this antenna should be inexpensive, and easily constructed with readily available parts from hardware and Radio Shack stores.

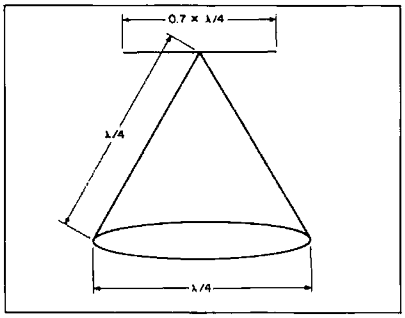

Figure 1. Design for the discone antenna.

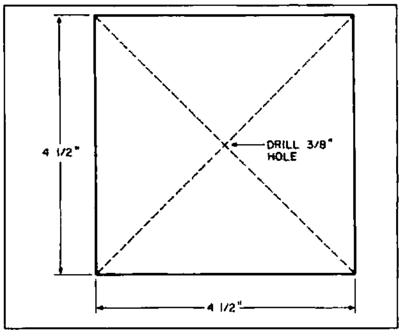

Figure 2. Dimensions of the disk support.

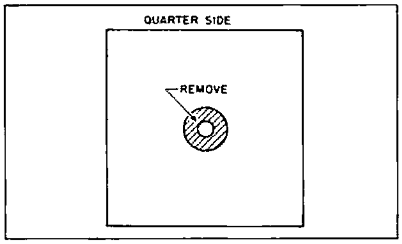

Figure 3. Disk support preparation.

Since I wanted to cover the two meter band, I picked the lower frequency limit to be below the lower band edge. The actual frequency I picked was 137 MHz. A decade of coverage should still give me up to 1370 MHz, which suited my needs. The equation for this is: ¼ wavelength = 2952/137 = 21.5" = cone side; disk diameter = 0.7 x 21.5" = 15".

Now all I had to do was figure out how to build it!

Constructing the Discone

See the "Parts List." The last three items came from Radio Shack. The ⅜" solder lugs are part of the package (two per package) of solder lugs from Radio Shack, but you can save money if you can find ⅜" solder lugs separately. I bought all of the other items in the electrical department of a local hardware store.

Now, let's get to work. We will first prepare all the individual pieces.

The disk support will be made out of the single-sided printed circuit board. First, cut this board into a 4½" x 4½" square. With a pencil, draw diagonal lines from corner to corner on one side. See Figure 2. Drill a ⅜" diameter hole at the intersection of the lines (the center of the PC board). Referring to Figure 3, center a quarter over the hole on the foil side of the PC board and trace around its circumference. Using a sharp X-ACTO™ knife, cut through the copper on the circular lines just traced. Now remove the copper *within* the circle. A soldering gun will aid in removing the copper foil.

The light fixture canopy needs some modification. These kits include a fixture for mounting a lamp on, a short length of 1/8IP threaded steel lamp pipe, and some additional hardware. Refer to Figure 4. Nibble or cut a slot along one side of the canopy at least 0.3" x 0.3". This will pass the coaxial cable when the canopy and antenna are mounted.

Cut all eight welding rods to a length of 21.5". Unless you have heavy cutters, you will need to use a hacksaw. Remove any insulation from the ⅜" solder lugs, insert only one end of the cut welding rods into the solder lug crimp end, crimp the lug and solder. See Figure 5.

Cut the remaining eight short pieces of welding rods to 7¼". Finally, determine the center of the 4" round plastic electrical box cover and drill a ⅜" hole. It is important that this hole be well-centered, so take care in determining this location.

Now take the 30" 1/8IP all-thread steel lamp pipe and carefully tin one end of the pipe. See Figure 6. Be careful not to get solder on the threads of the pipe. This pipe is

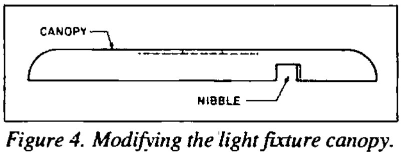

Figure 4. Modifying the light fixture canopy.

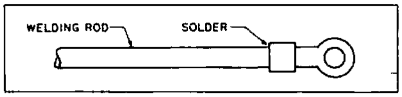

Figure 5. Element preparation.

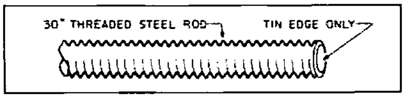

Figure 6. Tinning the pipe.

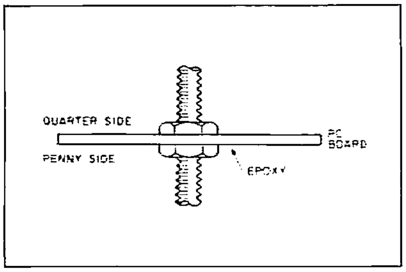

Figure 7. Disk support assembly.

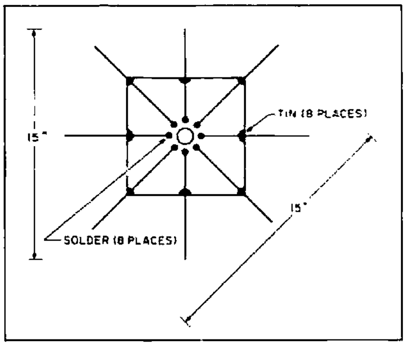

Figure 8. Tinning and soldering the top of the PC board.

not difficult to tin since it is made of steel, which doesn't conduct heat away as fast as copper or brass does. Cut 1" of the outer insulation off the RG-8M coaxial cable, separate the braid, and then fold it back over the cable insulation. Insert this end of the RG-8M cable into the non-tinned end of the 30" lamp pipe and push the cable through until the braid is flush with the tinned end of the pipe. Solder the braid to the pipe at this point.

Next, prepare the disk support printed circuit board. Insert a short length of steel lamp pipe (provided with the canopy kit) through the center hole in the printed circuit board and fasten it securely in place with two brass nuts. See Figure 7. Epoxy the brass nut to the PC board opposite the foil side. Be careful not to get epoxy on the threads. Now, remove the nut from the side of the board not epoxied, and unscrew the steel pipe from the nut still attached to the PC board. The side of the PC board with the nut will now be referred to as the bottom of the disk support PC board.

On the top of the PC board, tin each corner and tin the midpoint of each side. See Figure 8. Now solder down the 7¼" welding rods to the PC board, making sure that the total length from outer point to outer point is 15". You are creating a disk 15" in diameter out of the eight welding rods. Now go back and solder the inside edge of the welding rods to the PC board. Finally, place the 1" diameter brass washer over the ends of the welding rods centered over the hole in the PC board and solder the washer to the rods. See Figure 9.

Now it's time to start assembling the antenna. First, screw the end of the 30" pipe with the RG-8M center conductor sticking out into the nut on the bottom of the PC board. Screw it in just far enough so the end of the pipe is flush with the printed circuit side of the soldered down nut. The center conductor of the RG-8M will pass through the center of the brass washer on the top of the PC board.

Parts List

Description	Approximate Cost
1" diameter brass washer	$ .10
30" 1/8IP all-thread steel lamp pipe	$ 3.17
1 light fixture canopy kit	$ 2.45
6 brass 1/8IP nuts (pkg. of 6)	$ .99
1 plastic 4" round electrical box cover	$ .17
10 feet #12 copper wire ($.07/ft.)	$ .70
8 copper plated steel welding rods ($.20 ea.)	$ 1.60
12" x 24" x 1" piece of wood	$ 1.00
4½" x 4½" single-sided PC board	$ 3.99
6 ⅜" solder lugs (RS 64-3040 x 3)	$ 3.87
5 feet RG-8M (RS 278-1328 0.27 x 5)	$ 1.35
Total	$19.39

Next, place the solder lugs of the eight long steel welding rods over the 30" steel pipe and hold them in place with a 1/8IP brass nut. Put this nut on finger-tight and then arrange each long rod so that it is exactly under each short rod on the top of the PC board. Carefully tighten the brass nut. Thread another brass nut on the steel pipe and position it about 3" below the nut holding the long rods in place. Hold the pipe upright with the PC board at the upper end, then bend all the long rods down along the steel pipe. Place the plastic electrical outlet cover over the steel pipe and thread on another brass nut. Push the electrical outlet cover up the pipe and spread the long welding rods until the bottom ends of the rods are 21.5" apart from their opposite rod. Adjust the nut positions as necessary and tighten the nuts to hold the electrical outlet cover in place. See Figure 10. I used a hot glue gun to attach the long welding rods to the plastic electrical outlet cover to help with the antenna rigidity, but this is not really necessary.

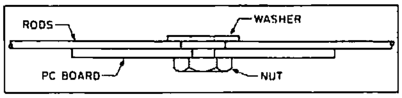

Figure 9. Finishing the PC board.

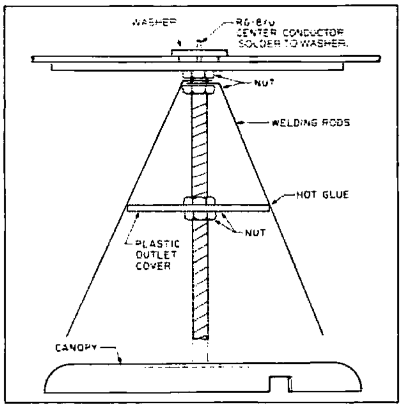

Figure 10. Assembling the discone.

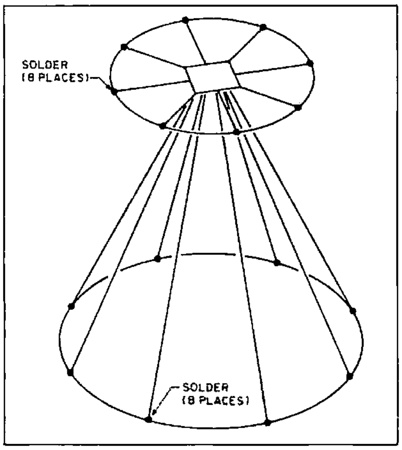

Figure 11. Wire placement.

Strip the insulation off the RG-8M center conductor as it passes through the brass washer on the top of the printed circuit board. Solder the center conductor to the brass washer. Now, mount the antenna to the canopy by threading another brass nut over the end of the steel pipe, passing the cable and pipe through the hole in the canopy, and threading another nut over the pipe and tightening it. You can now attach the canopy to a piece of wood (I used a 1' x 1' x 1" board), thus allowing the antenna to stand freely.

The last thing to do is to solder a piece of #12 copper wire around the circumference of the disk and cone. Cut a 50" piece of wire for the disk and a 70" piece of wire for the base of the cone. Tin the ends of each of the welding rods and solder the copper wire to them. See Figure 11. Though it is not really necessary to tie all the welding rod ends together, this and the hot glue mentioned earlier make the antenna very rigid.

Finally, attach your connector of choice to the end of the RG-8M coming from the discone. RG-8M has the same dimensions as RG-59. A PL-259 UHF connector with a RG-59 reducer or a BNC connector for RG-59 cable work well.

Operation

How does it work? I measured an SWR of less than 1.5 to 1 on all ham bands between 144 and 1296 MHz. I placed the antenna on its wood base in my attic and it provides excellent general coverage reception, as well as transmission in the covered ham bands. Not bad for about an hour's worth of work and less than $20 worth of parts! 73

Contact Phil Salas AD5X at 1517 Creekside Drive, Richardson TX 75081.

High Speed Data Acquisition

Sample the outside world with this inexpensive interface.

by Mike Gray N8KDD

Personal computers have made huge improvements in nearly every field, including the scientific and engineering communities, acquiring and processing data for research projects. Hams, too, have made extensive use of computers, and many have an interest in using them for data acquisition.

To do this, all a computer needs is an input device and appropriate software. The keyboard is the most commonly used input device. Data taken manually from individual instruments is recorded on paper and entered later. However, keyboards are unacceptably slow for most projects, so an instrument such as a datalogger or a data-acquisition card is used.

Information stored in a datalogger is usually entered into the computer through the serial port, sometimes by means of a telephone or radio modem. Commercial dataloggers are too costly for most of us to justify the purchase of even the least expensive model.

A bus-oriented data acquisition card installed in a personal computer is a powerful, though expensive way to build a digital data acquisition system. Most portable computers will not accept a data acquisition card, so work is usually confined to a laboratory using a desk computer.

Many projects need only one channel of data, acquired at relatively high speed, and this project will satisfy that requirement at very low cost.

Hacker Method

Another means of getting data into a computer is through the parallel printer port. This port is generally not used for anything but driving a printer, but like most things, it can be adapted (hacked?) to other uses. Data can be transferred much faster in parallel than in serial form.

There are three port addresses at the printer connector of IBM-compatible computers. At 378 (hexadecimal) is the 8-bit data word. This address is all that we'll discuss for now. Address 378 is LPT1, and most compatibles are configured in this manner. LPT2 is address 278 (hex). Some computers may be configured such that the data lines appear at address 3BC (hex); check your manual for

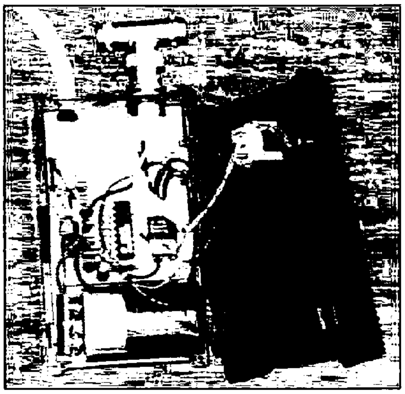

Photo A. Inside view of the A-D box.

the proper address for your system. Note that the BASIC program will have to modified for your computer system's port address if different than 378 (hex).

Printer connector pins 2-9 correspond to data bits 0-7. Pins 18-25 are grounded. If a pin is high, grounding that pin saturates the output driver and the logic state changes from 1 to 0. Communicating over the parallel port in this manner is easy, but it also inverts the conversion result. It's a simple matter to fix that in the software.

A-D Converter

An analog-to-digital (A-D) converter chip converts an analog value to its binary equivalent. The chip requires a reference voltage, against which the analog signal is compared. In most cases, the reference voltage is 5 volts, the same as the supply voltage.

The Data Bit output lines are numbered DB0–DB7. These lines are connected to pins 2-9 at the computer printer connector.

If the analog input voltage is zero, all eight lines will be low (0 volts), and the decimal value of the 8-bit data word will be zero. If the analog input is greater than or equal to the reference voltage, all eight lines will be high (5 volts), and the decimal value of the 8-bit data word will be 255. An 8-bit A-D converter has a maximum resolution of 256 (0-255 counts).

The amount of current required to drive the printer port of many computers is greater

Photo B. The interface hooked up to an IBM PC clone.

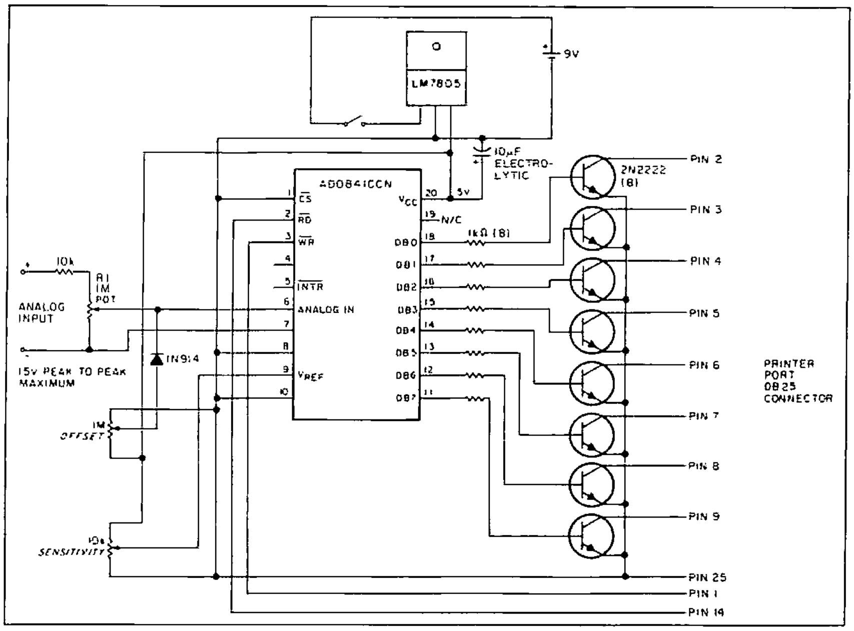

Figure 1. Schematic diagram of the interface.

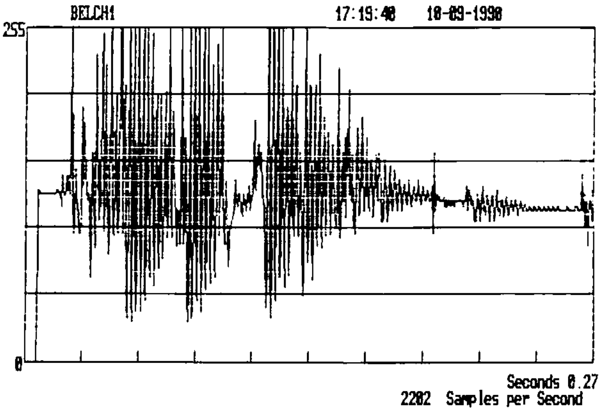

Figure 2. Unusual audio waveform as sampled by the interface.

than the A-D converter chip can handle, so external drivers are necessary. I chose common NPN transistors.

In addition to the data bit lines 0–7, two more lines from the printer connector are required. These control the A-D converter. They are found at address 37A (LPT1), 27A (LPT2) or 3BE on some computers. Pin 1 controls when the chip performs a write (WR), and pin 14 controls when the chip performs a read (RD). Both lines need to be set high initially, then WR is pulled low, which starts a conversion. After WR is asserted high, RD can be pulled low and the conversion result will appear at the output lines.

Precaution

Grounding any of the printer port pins 2–9 pulls the voltage below the threshold necessary for the computer to recognize a logic 1. The logic levels vary, but all are under 0.8 volts. Some computers are capable of driving very high loads, which means that the current required to pull the pin voltage below the logic level threshold could be as high as 60 mA per pin.

In testing five different computer brands, I have not found even one to be damaged by grounding these pins, but the drivers may get warm after a while. In order to protect the computer from any possible damage, the printer port should be held in a high state only long enough to read an input from the A-D converter. The software will accomplish this.

Once completed and working, the converter should not be connected to the computer for more than 10 to 20 minutes, unless the converter is off, the analog input is zero, or the software is running. The software program allows current to flow only long enough to read the port.

Construction

Since the component count is low, the circuit can be assembled on perfboard. The chip is static-sensitive, so mount a 20-pin socket to the board and install the chip only after assembly is complete and the wiring has been checked.

The sample rate is entirely dependent upon the speed at which the computer can toggle the WR and RD lines, and interrogate the printer port. The operation of this chip is described in greater detail in the *National*

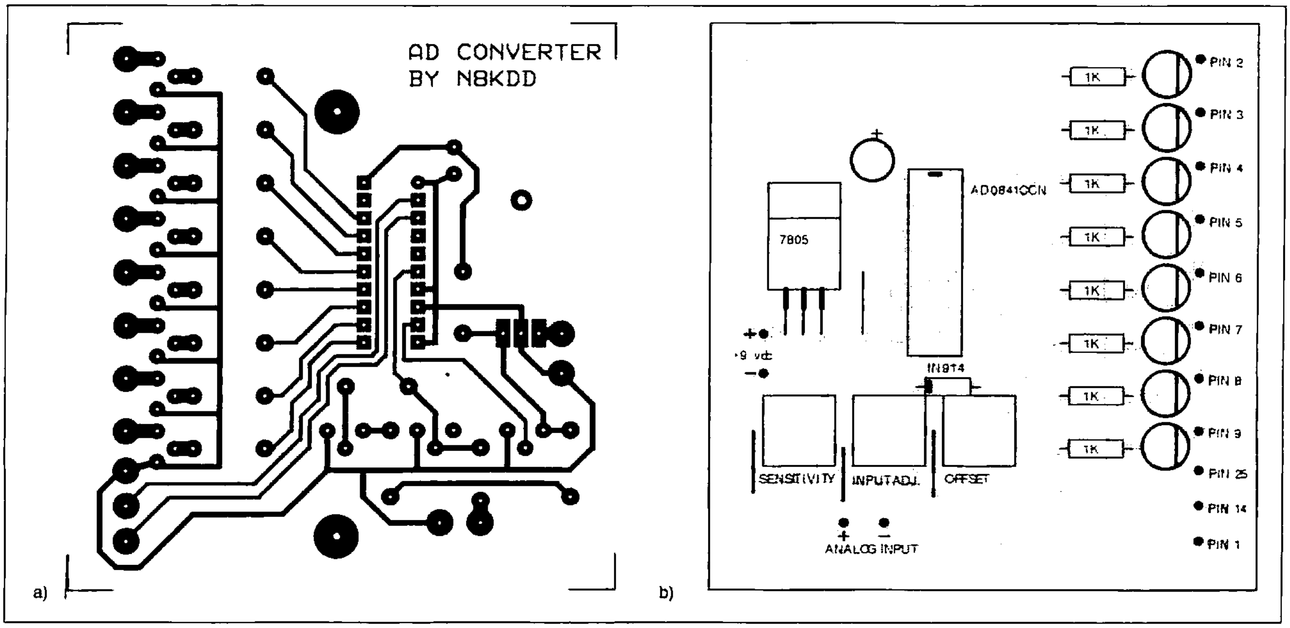

Figure 3 (a). PC board foil pattern. (b). Parts placement.

Semiconductor Linear Databook, Volume 2.

The A-D converter chip may be destroyed if more than 5.1 volts are applied to the input. R1 should be adjusted to divide the input voltage by three, so that there won't be any damage unless the input is greater than 15 volts. The offset and sensitivity potentiometers allow the instrument to measure bipolar inputs, and to measure low level signals with good resolution. If you measure only signals between 0 and 5 volts, all three pots may be eliminated.

Smoke Test

Make sure the power switch on the converter is off, then plug the DB-25 connector into the printer port on the computer. Load BASIC and add the following line to the program listed in the sidebar:

65 Y=255-Y.

(Since the NPN transistors cause a bit inversion, the bits must be inverted again in order to get representative data.) Now run the program listed in the sidebar.

Adjust the offset and sensitivity pots to midscale and turn the power switch on. The display will read something between 0 and 255, depending on where the pots are set. Turn the offset pot and watch the decimal value change.

Software Suggestions

The application possibilities are endless, and everyone has his own particular reason for getting analog information into his digital computer. An experienced Gizmologist should be able to build a custom program around the core program listed in the sidebar.

You can connect many different transducers to your new A-D converter. I have used these transducers with good results: audio, position, displacement, temperature, strain.

The software you write can convert the raw A-D counts to engineering units for you. If, for example, you have a position transducer which produces 5 volts when it is 100 percent extended, simply divide the variable "Y" by 2.55 (Y=Y/2.55).

The computer can make graphs while taking data, although the more you ask the computer to do, the slower it gets. If you want speed, acquire the data first, then plot it. The plot in Figures 2 were made with an IBM AT using the acquire-then-plot technique. The transducer was an audio amplifier. If you measure some slowly changing physical event such as temperature, program execution speed is not of much concern, but an accurate time base is. If you would like a copy of some general purpose, graphic-oriented programs, you can download them free from the *73 Magazine BBS* at (603) 525-4438 or send $6 to me at the address below. Be sure to specify whether you would like a 5.25 or 3.5 inch disk.

A 9 volt alkaline battery will last about six hours in continuous use. You could use a filtered power supply or larger battery pack if you need longer service. ■

Contact Mike Gray N8KDD at 465 W. Maple Rd., Milford MI 48381.

Parts List

1	ADC0841CCN	A-D converter (price is under $10)	Pioneer Standard Electronics, 13485 Stamford, Livonia MI 48150
8	2N2222	NPN Transistors (metal can preferred)	
8		1k ohm resistors, ¼ watt	
1		1 megohm board mount potentiometer	
1		10k ohm fixed resistor	
1		10k ohm panel mount potentiometer	
1		1 megohm panel mount potentiometer	
1	LM7805	5 volt regulator	
1		SPST panel mount switch	
1		9 volt battery clip	
1		10 µF electrolytic capacitor	
1	DB25	Male printer port connector	
1	1N914	Diode	
		About 2 feet of 11 (or more) conductor cable	
1	276-150	IC circuit board (Radio Shack)	
1		20-pin IC socket	

(Most ol these components can be purchased at Radio Shack. You may also be able to order the A-D chip at a local Radio Shack.)

Note: A blank PC board is available lor $4 + $1.50 shipping from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Port Experiments

In the following experiments, I used BASIC to control the A-D converter and read the printer port. Any other programming language will work, but I like BASIC because it's so easy to use and explain. All of the *.EXE files for my applications were written using Borland's Turbo BASIC™, and the source code is available for those who want to write their own software applications. Turbo BASIC runs about eight limes faster than BASIC interpreter.

The following program reads the bit status at the printer port. The monitor displays the decimal value and bit status of a byte read from the printer port.

BASIC Interpreter (BASICA or GW-BASIC)

```
10 OUT &H37A,12                  'WR and RD high
20 OUT &H37A,13                  'WR low
30 OUT &H37A,12                  'WR and RD high
40 OUT &H37A,14                  'RD low
50 OUT &H378,255                 'latch all bits high
60 Y=INP(&H378)                  'input 1 byte (variable y)
70 PRINT Y,BIN$(Y)               'print Y (decimal and binary)
80 OUT &H378,0                   'latch all bits low
90 Q$=INKEY$                     'keyboard trap
100 IF Q$="q" OR Q$="Q" THEN END 'if user enters q then quit
110 FOR D=1 to 2000:NEXT         'time delay
120 GOTO 10
```

Turbo BASIC

```
do
out &H37A,12                     'WR and RD high
out &H37A,13                     'WR low
                                 out &H37A,12 'WR and RD high
out &H37A,14                     'RD low
out &H378,255                    'latch all bits high
y=inp(&H378)                     'input 1 byte (variable y)
print y,bin$(y)                  'print y (decimal and binary)
out &H378,0                      'latch all bits low
q$=inkey$                        'keyboard trap
if q$="q" or q$="Q" then end     'if user enters q then quit
delay .5                         'time delay
loop
```

You should see 255 11111111 on your monitor. If not, double check the program code and run it again. You may need to change the port address from &H378 to &H3BC. While the program is running, connect a jumper wire between pin 25 and pin 9. The display will now read 127 01111111. The left-most bit is the most significant. It has a value of 128. Connect pin 25 to pin 2. The decimal value is now 254. Pin 2 is the least significant bit of the 8-bit word and it has a value of 1. Try connecting each pin to pin 25, and watch the display. You will see this pattern develop:

Bit	Pin	value (bit high)	
0	2	1	least significant bit
1	3	2	
2	4	4	
3	5	8	
4	6	16	
5	7	32	
6	8	64	
7	9	128	most significant bit

Software for the Ham Shack, Part IV

Useful ham calculations you can program yourself!

by Bill Clarke WA4BLC

This is the fourth, and last, part of this series of articles. The Ham System has grown to be quite capable of saving time and aggravation for the user.

Let's add the last modules to the system. This month the MAIN MENU will grow to nine choices. Added will be:

8 - RESISTOR COLORS TO OHMS
9 - AIR COIL INDUCTANCE

Module Eight

Last month, you added module seven, which gives you the resistor color codes when you enter the value of ohms required. This month, with module eight, you get to do the reverse: Enter the color codes and get the value in ohms.

Module Nine

Have you ever looked in the junk box and come up with an air-wound coil of unknown value? This last module asks for the physical dimensions of the coil, then gives you its value in microhenries. No more unknown coils!

Entering the Listing

Before you add program lines from this month's listing, you must first LOAD "HAM3". After it is loaded, LIST it. Then you are ready to start typing in the new material.

After you have completed typing in all the lines, save it under the name HAM4.

Using the New Program

LOAD the new program by typing LOAD "HAM4" and pressing ENTER. When the computer signals READY on the screen, type RUN and press ENTER.

The next thing you should see is the MAIN MENU for your new Ham System. It should show nine selections: ANTENNA DESIGN MATH, TRANSMISSION LINE MATH, OHM'S LAW, POWER FORMULAS, EFFICIENCY FORMULA, RADIO HORIZONS, OHMS TO RESISTOR COLORS, RESISTOR COLORS TO OHMS, and AIR COIL INDUCTANCE.

Clone users, put GWBASIC on a disk and add this handy batch file to start your system: At the DOS prompt type:

```
A> COPY CON HAM4.BAT
   ECHO OFF
   CLS
   GWBASIC HAM4
   (function key F6)
```

Press ENTER after each line.

C-64 Modifications

C-64 users remember the modifications listed in Part 1 of this series and the following:

Replace the listed lines as follows:

```
810 INPUT "FIRST BAND COLOR ";F$
811 INPUT "SECOND BAND COLOR";S$
812 INPUT "THIRD BAND COLOR ";T$
831 PRINT "THE  RESISTOR VALUE IS:"
832 PRINT F$S$T$" OHMS"
910 INPUT "DIAMETER IN INCHES: ";D
911 INPUT "LENGHT IN INCHES:   ";L
912 INPUT "NUMBER OF TURNS:    ";N
921 PRINT "INDUCTANCE = "FNA(L)" MICRO HENRYS"
```

HAM4 Listing

```
21 PRINT SPACE$(26);"8 - COLOR CODES TO OHMS"
22 PRINT SPACE$(26);"9 - AIR COIL INDUCTANCE"
39 IF M$ = "8" THEN 800
40 IF M$ = "9" THEN 900
800 CLEAR : CLS
801 PRINT SPACE$(25);"RESISTOR COLOR CODES"
802 PRINT SPACE$(20);"------------------------------"
803 PRINT : PRINT : PRINT
810 INPUT "ENTER THE COLOR OF THE FIRST BAND ";F$
811 INPUT "ENTER THE COLOR OF THE SECOND BAND";S$
812 INPUT "ENTER THE COLOR OF THE THIRD BAND ";T$
820 X$ = F$
821 GOSUB 850
822 F$ = A$
823 X$ = S$
824 GOSUB 850
825 S$ = A$
826 X$ = T$
827 GOSUB 870
828 T$ = A$
830 PRINT : PRINT : PRINT
831 PRINT "THE RESISTOR VALUE IS: "F$S$T$" OHMS"
832 PRINT
840 PRINT "N - TRY AGAIN"
841 PRINT "M - MAIN MENU"
842 M$ = INKEY$
843 IF M$ = "N" THEN 800
844 IF M$ = "M" THEN 10
845 GOTO 842
850 IF X$ = "BLACK" THEN A$ = "0"
851 IF X$ = "BROWN" THEN A$ = "1"
852 IF X$ = "RED" THEN A$ = "2"
853 IF X$ = "ORANGE" THEN A$ = "3"
854 IF X$ = "YELLOW" THEN A$ = "4"
855 IF X$ = "GREEN" THEN A$ = "5"
856 IF X$ = "BLUE" THEN A$ = "6"
857 IF X$ = "VIOLET" THEN A$ = "7"
858 IF X$ = "GRAY" THEN A$ = "8"
859 IF X$ = "WHITE" THEN A$ = "9"
860 RETURN
870 IF X$ = "BLACK" THEN A$ = ""
871 IF X$ = "BROWN" THEN A$ = "0"
872 IF X$ = "RED" THEN A$ = "00"
873 IF X$ = "ORANGE" THEN A$ = ",000"
```

Continued on page 36

Number 9 on your Feedback card

73 Review

by Bill Brown WB8ELK

The TAPR METCON-1 Kit

Tucson Amateur Packet Radio (TAPR)
P.O. Box 12925
Tucson AZ 85732-2925
Tel. (602) 749-9479
FAX: (602) 749-5636
Price Class: Main Board, $85;
V-to-F Converter, $25; Temperature Board, $30.

Add telemetry and control to your packet station.

How would you like to have the ability to read sensors or control circuitry from a remote location via packet radio? Thanks to a new kit from the folks at TAPR (Tucson Amateur Packet Radio), it's now easy to take full advantage of advanced packet control.

Packet Telemetry

The METCON-1 kit (TeleMETry CONtrol) is a versatile telemetry/control unit that uses a serial port for communications. You can send commands to the METCON-1 board via a computer serial port, telephone modem or a packet TNC.

The METCON-1 board simply hooks up between a packet TNC's serial port and the circuits you want to control or sense.

One of the most obvious uses for the METCON-1 board would be in a remote repeater installation. Useful information such as building temperature, amplifier temperature, backup battery voltage, and AC power status can be easily sent back at fixed intervals (or upon a connect request). You can also use the METCON-1 to turn on transmitters, lights, amplifiers, antennas, and just about anything else that can be activated by a relay.

The METCON-1 board also looks at the status of binary inputs. Whenever it detects a change in one of these lines it automatically sends out a status message. I use this feature as an intruder alert in my installation. I hooked up the METCON-1 to a micro-switch that closes whenever anyone opens the hamshack door! Since the METCON-1 has a built-in clock, it actually sends me a timestamp of the event (I know exactly when the door was opened!). Not only can the unit detect "On/Off" transitions on its six inputs, it can measure frequency as well (0 to 10 kHz).

Kit Assembly

The kit comes complete with all components as well as a high quality doubled-sided PC board. An optional voltage-to-frequency interface board is also available. Component placement is well-marked and silk-screened onto each board to make assembly a real breeze.

Construction was quite straightforward and went easily. The assembly instructions were excellent, with every step spelled out in detail. The checklist format helps ensure that you don't miss a step or component. Since this is a double-sided board with plated through-holes, it's important to take care in assembly. Removing components from a double-sided board could be difficult.

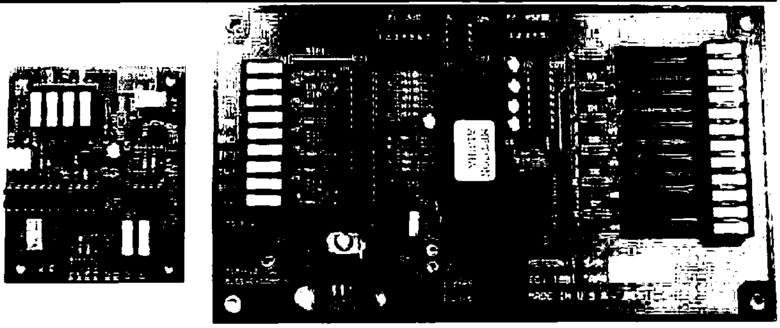

Photo. The assembled TAPR METCON-1 telemetry and control unit. The smaller PC board to the left is the optional V-to-F interface board.

Sockets are provided for all ICs. I particularly like the connectors used for interfacing to the outside world. You just slide a wire into the hole and hold it in place with a snap lever (no soldering!). This scheme also makes it easy to quickly change your external wiring (particularly useful when you're at a remote repeater site).

Installation

The METCON-1 board communicates via its serial port. You can use a telephone modem, computer serial port, or a packet TNC to send commands and receive data. In a typical packet hookup, you just connect the METCON-1 lo your packet TNC's serial port and hook up the items you want to control to any of the six onboard relays. The six inputs to the METCON board can be used as "On/Off" detectors. These inputs can also function as a frequency counter which allows use of a voltage-to-frequency interface board.

The V-to-F Interface

Through the use of the optional V-to-F (voltage to frequency) board, sensors can be interfaced to the METCON-1. Any device that outputs a voltage between 0 to 10 volts (when configured for low input range) or 0 to 100 volts (high input range) can be measured. You can also configure the V-to-F board to function as a temperature sensor. Each V-to-F board hooks up to one of the input ports of the METCON-1 board. You just read out the frequency on the main memory map output. In the case of voltage, just divide the frequency by 10. To get temperature readings you must divide by 10 and then subtract 100.

The voltage-to-frequency scheme has some intriguing advantages over traditional A-to-D (analog to digital) converters. Since the voltage level is converted to a frequency directly at the source, it doesn't suffer from voltage drops or noise when using long wire leads from a sensor. The drawback to this method is that it takes a full second for each sample (each channel). For most applications this is more than sufficient. However, you can plug an optional ADC (analog-to-digital converter) directly into the METCON board if you desire. The ADC board is a future option that is not currently available.

Operation

Commands to the METCON-1 are performed in individually addressed bits or bytes. Each area of the METCON's memory contain specific locations for input and output status, frequency counter output, system configuration and A/D conversions. You can display a memory location, write to it or reset it. All commands are preceded by an "=" sign and a METCON station address (in case you have more than one METCON board in your system—The default address is "A").

```
-A- SUN/910624/0556/0C AUTO TIMEOUT FOR MEMORY DISPLAY

  P6         P5         P4         P2         P0
0000 0000  0000 0000  0000 0000  0000 0001  0000 0000  OUT  (08 07 06 05 04)
0000 0000  0000 0000  0000 0000  0000 0001  1101 1110  IN   (0D 0C 0B 0A 09)
0000 0000  0000 0000  0000 0000  0000 0001  1111 1111  CHG  (12 11 10 0F 0E)

  7      6      5      4      3      2      1      0
00000  00000  00000  00000  00000  00000  00000  01253  FREQ CTRS

 7    6    5    4    3    2    1    0
255  255  255  255  255  255  255  255  ADC

-A- MEMORY DISPLAY COMPLETE
```

Figure 1. The METCON-1 memory map can be sent out every 15 minutes (or every minute) for testing. Output port P2 shows that relay 0 is activated, input port P0 shows a closed circuit on input 6 and the frequency counter indicates a temperature of 25.3°C.

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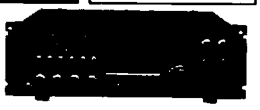
	LIST	
FT-767 GX Gen. Cvg Xcv	2299.00	Call $
FT-757 GX II Gen. Cvg X	12 .00	Call $
FT-7000 15m–160m AMP	.00	Call $
FT-212RH NE 45w	.00	all $
FT-712RH 70cm		Call $
FT-290R All Mode		Call $
FT-23 R/TT		Call $
FT-736R, All		all $
FT-470 2m/70cm		Call $
FT-747 Gen'l		Call $
FRG 8800 H		$
FRG 9600 UHF Rcv		Call $
FT 690 R/H		Call $
FT 790 R/H		Call $
FT 4700 Dual Band Mo e		Call $
FT 411 2 Meter HT	408.	Call $
FT 811 440 HT	410.00	Call $

Yaesu
New FT-990
HF All-Mode
ICOM

	LIST	
IC-781 New Deluxe HF Rig	6149.00	Call $
IC-765 Gen. Cv Xcvr	3149.95	Call $
IC-735 Gen. Cvg	114	Call $
IC-751A Gen. Cv	0	Call $
IC-R7 130	.00	Call $
IC-R71A		Call $
IC-228A/H		Call $
IC-28A/H	99	Call $
IC-2		Call $
IC-900 Six		Call $
IC-3S AT	.00	Call $
IC-2S A	0	Call $
IC-4S AT		Call $
IC-48A FM Mobile 2	9.00	Call $
IC-4GAT New 6w HT	9.95	Call $
IC-38A 25w FM Xcv	489.00	Call $
IC-32AT 2m/70cm HT	629.95	Call $

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2663 County Rd. I
Mounds View, MN 55112
Super Minnesota Watts 1-800-279-1503
CIRCLE 153 ON READER SERVICE CARD

METCON-1 KIT *Continued from page 34*

For example: The memory address for the six relay outputs is location number 05. To turn on relay 1, you send the command "=AS050". The "S" is the set command, the "05" is the memory address, and the "0" is the relay number. To turn off the relay, you just need to send the clear command: "=AC050". If you want to look at the memory location, the command is "=AD050" ("D" for display). That's really all there is to it. If you want to turn on or off several relays, you can send a byte write command that sets all of the control bits in one operation. Example: "=AWY050F" turns on relays 0,1,2 and 3 simultaneously, since the "0F" address sets the lower 4 bits "On".

For repeater or remote base control, the password feature adds a level of security. You can set up certain portions of memory as restricted. In this mode, you need to logon to the METCON-1 with a password in order to perform control operations.

Impressions

I have the METCON-1 installed in the W2NSD/1 hamshack. It's hooked up to a 10 meter CW beacon transmitter, a low-power 2m FM transmitter, an ATV transmitter, a TV camera, and lights. Whenever I want a signal source on ATV, 10 or 2 meters, I just connect up on packet and have a blast turning the equipment on and off remotely. I use the inputs to measure the shack temperature as well as to indicate when the shack door is opened.

Sure, I could've done part of this with a touchtone decoder, but the METCON-1 system allows me to control things error-free, as well as provide real-time telemetry.

The review unit was the preliminary version of METCON-1 (Alpha Test). I found the assembly instructions to be very complete and easy to follow. For those of you with the preliminary manual, you may have to dig around a bit to understand how all of the commands work, however. Once you figure out how the memory addresses are configured, you'll be well on your way to controlling things.

To some extent, you do have to decipher the values presented to you in the memory map. The METCON-1 board won't come right out and tell you "The Temperature is:" or "Battery voltage =." Once you have figured out the memory map, you can easily read your system's status.

For those hardware and software hackers out there, there is room to add a substantial amount of I/O capability to this system. There is provision for a fast upload and download of the system memory. You could write a program to display this information in graphics form for a really spectacular display in an easy-to-read format.

The METCON-1 system is a powerful and economical tool for anyone considering remote control applications. You'll probably wonder how you got along without it! 73

Hamshack Software *Continued from page 32*

Listing continued

```
874 IF X$ = "YELLOW" THEN A$ = "0,000"
875 IF X$ = "GREEN" THEN A$ = "00,000"
876 IF X$ = "BLUE" THEN A$ = ",000,000"
877 IF X$ = "VIOLET" THEN A$ = "0,000,000"
878 RETURN
900 CLEAR : CLS
901 PRINT SPACE$(26);"AIR COIL INDUCTANCE"
902 PRINT SPACE$(20);"------------------------------"
903 PRINT : PRINT : PRINT
910 INPUT "ENTER THE COIL DIAMETER IN INCHES: ";D
911 INPUT "ENTER THE COIL LENGTH IN INCHES:   ";L
912 INPUT "ENTER THE NUMBER OF TURNS OF COIL: ";N
915 A = (D*D)*(N*N)
916 B = (18*D)+(40*L)
917 L = A/B
918 GOSUB 390
920 PRINT
921 PRINT "THE INDUCTANCE IS: "FNA(L)" MICRO HENRYS"
930 PRINT
931 PRINT "N - TRY AGAIN"
932 PRINT "M - MAIN MENU"
933 M$ = INKEY$
934 IF M$ = "N" THEN 900
935 IF M$ = "M" THEN 10
936 GOTO 933
```

When you want to use HAM4, just place the disk into the drive and type "HAM4", then press ENTER. GWBASIC will execute, and HAM4 will load and run. The bottom light bar will be extinguished, leaving a very professional appearing menu.

Comments

The system has grown over the past few months. I sincerely hope you find it as useful as I found it fun to write. If you would like for the system to grow more, write me. I would consider doing an update from time to time.

For readers not wishing to type in the many lines of program code that have appeared in this series, I will make copies. The cost is $5, which includes the disk, copying, and shipping. SPECIFY CLONE OR C-64. Write to me at the address below. Also, each module as well as the complete program can be downloaded from the *73* BBS at (603) 525-4438. Look for the listings under the *73mag* SIG. 73

You may write Bill Clarke WA4BLC at RD #2 Box 455-A, Altamont NY 12009. Please enclose an SASE for a reply.

Universal CAT Interface

Control your rig with your computer!

by Art Harding K5YEF

Many of us got excited in the early '80s when microprocessor radios appeared on the market. This heralded the beginning of the patching together—"interfacing"—of personal computers and amateur radio equipment. This offered the promise of menu-driven radio operation, vastly increased and enhanced memory, complete rig status display on the computer monitor—and the imagination went wild.

But there is a hitch—many computers and microprocessor rigs can't "talk" to each other directly. Most rigs want to converse with Transistor-Transistor Logic (TTL) bit transfer levels between 0 and +5 volts, but most of our computers demand that the digital dialogue go along RS-232C levels, which are from −12 to +12 volts. Commercial interface units mean more bucks, and, well, someday maybe we'll get around to creating one. And so for many of us, the rig and the computer remained separate. *[Ed. Note: Many modern rigs have a computer control port. They are known as Computer Accessed Transceivers (CAT)].*

Birth Of The Project

For me, "someday" finally came. After operating Yaesu's FT-980 HF radio for several years, the itch for CPU control got too strong, and I set forth to design and build the interface.

What follows is a solution, not just for the IBM and FT-980, but for any computer with an RS-232 serial port and a CPU radio with a TTL port. You can keep it simple on a breadboard or you can build up a permanent black box for full-time operation.

Digital Transfer

Figure 1a shows a random RS-232 waveform coming from a computer's serial port. The waveform needs to be converted to TTL levels for the radio. Note that the signal is inverted at the TTL port from whence it came. It could have been left in phase, and the software signals programmed to make 1's into 0's and vice versa. But this step can be eliminated by the hardware, and that's the course I took, preferring to keep the software simple.

In Figure 1b, the reverse takes place. Many radios send back command echoes, confirmation and status signals, for the computer to process. Again, an inverting action is desirable.

Refer to Figure 2, a portion of the FT-980 schematic for the CPU section. Note that any interface circuit must deliver its output data stream into a load of at least 165 ohms (330/2)! However, the serial data stream out of the radio is a stiff NPN switch, a nice signal to work with.

I could not get my hands on all microprocessor-controlled radios, of course, but on-the-air surveys indicated that the FT-980 radio is a good test bed for circuit development for other CPU radios on today's market. So, even if you're not dealing with this specific configuration, it's worth it to read on!

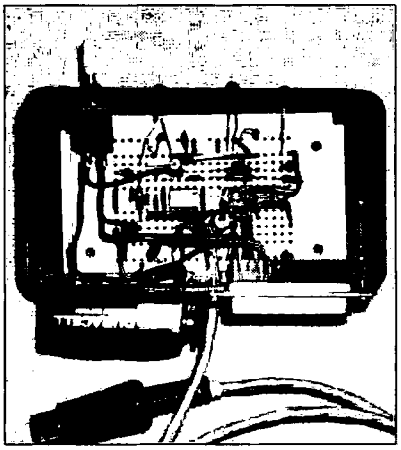

Photo A. The components were mounted on an Experimenters Socket which fits neatly into a case available from Radio Shack (no soldering!).

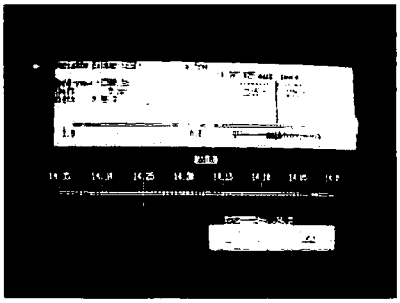

Photo B. The CAT980 program display. This full-featured program is available from the author as shareware (see the Parts List for details).

A Simple Interface Circuit

The result is the circuit shown in Figure 3. An old friend, U1, an LM324 quad op amp, does the job with two of its amps still unused. U1a acts as an inverting, saturating differential voltage comparator with a Schmitt trigger personality, and U1b does the same thing in the reverse direction.

They are not identical circuits, however. U1b drives the TTL input to the radio, the low 165 ohm load mentioned above. The idea is to only draw serious power when the negative going or "ground" level pulses occur. As the RS-232 pulse from the computer goes positive on pin 2 of the input connector, the output is driven negative through R7 and D2. D3 clamps the pulse so that it just stays above ground level, yet low enough to be read as a zero TTL signal. The negative input pulses, or static state (no commands being sent to the radio), draw minimum current from the power source.

U1a doesn't have quite the demand on it to perform its function of converting TTL signals from the radio to the computer. R1 was originally 18k during software development, and that value seems to work fine for IBM and compatibles. When I used a laptop, I found more drive was needed. I settled on a value of 3.3k, which has worked with all computers used to date.

Figure 3 shows you all that you will need to breadboard a no-frills interface in order to try some of your programming ideas. You can easily put it all on a Radio Shack Experimenter Socket (RS 276-175), and use cable ties to hold down the interconnecting cables to the breadboard. *[Ed. Note: The Radio Shack prototype board is an excellent way to quickly build circuits without any soldering.]* I used this circuit for eight months during

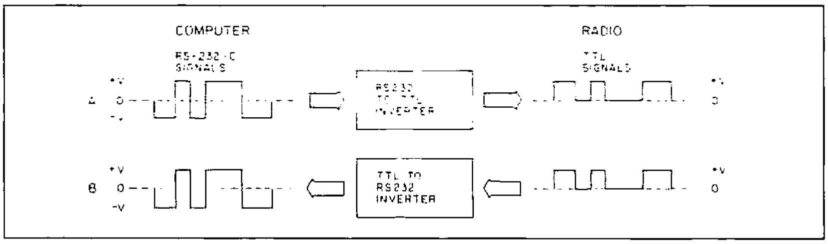

Figure 1. Interface signal path.

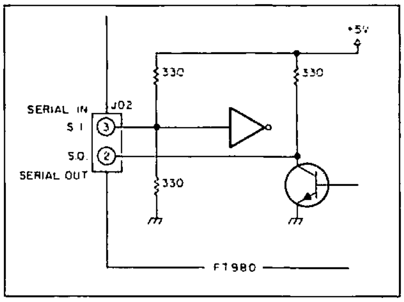

Figure 2. FT-980 CAT typical port circuit (part of the radio).

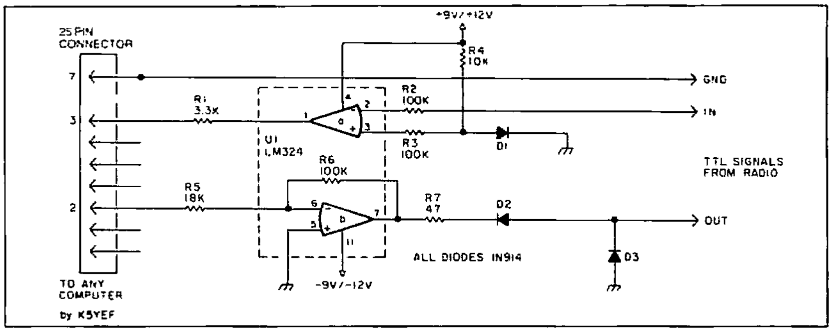

Figure 3. Simple CAT interface.

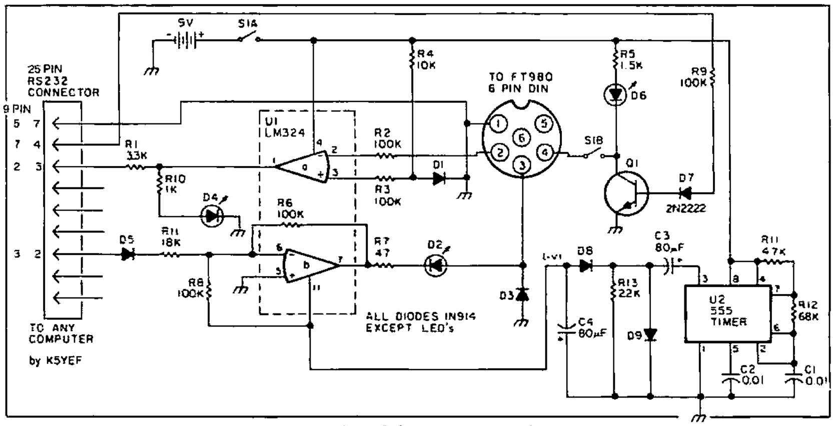

Figure 4. A deluxe CAT interface.

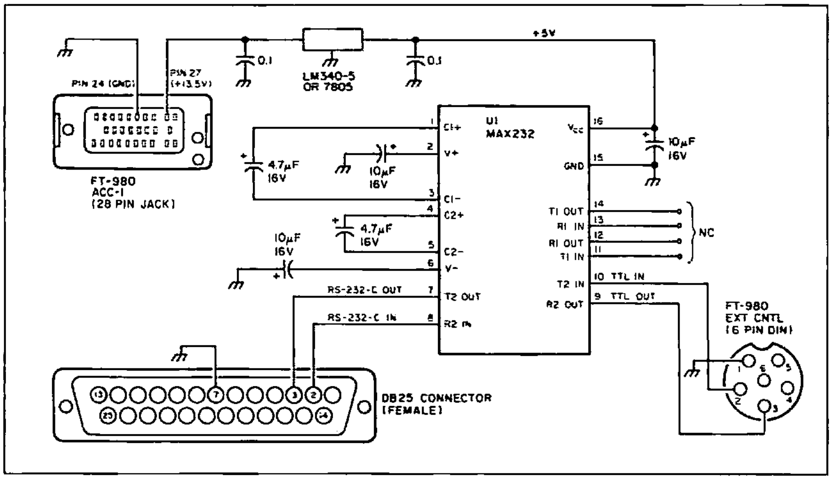

Figure 5. 'An alternative interface circuit that simplifies the circuitry. Thanks to M.G.D. Vermeulen ZS1HQ for this design.

software development, with a power source of two 9 V batteries, which I switched in and out as needed.

A Deluxe Interface

When the last line of code was written (though we who write code know that no such time ever comes!) and a couple of operating months went by, I wanted a permanent black box with only one battery to mess with. Or maybe no battery at all! Figure 4 shows the results. In the final version, I added a number of refinements, which we'll examine.

It seemed most desirable to have a visual handle on the operation of the interface, some lights that showed what was going on. When writing software and dealing with a computer port, the nagging question often is: Did that command go out the port like it was supposed to? By replacing D2 in Figure 3 with an LED, not only is this question put to rest, but the same LED also signals the transition of the command to a TTL level. When serial positive-going pulses output the computer port, D2 will light up as U1B, making the signal negative-ground going.

The addition of R10 and LED D4 serves the same function for inputs to the computer after TTL to RS-232 transition. A new diode, D5, blocks negative RS-232 levels from the computer, yet passes the all-important positive-going levels.

I have added a new circuit consisting of Q1, D6, D7, R5, and R9, to control a radio key line with a computer. I chose the RTS line in the computer port to key the radio. A positive signal on this line saturates Q1 and grounds pin 4 of the 6-pin DIN radio connector that keys the rig. Note that D6 is also an LED, so the operator has a visual on-the-air light. This is optional, but the odds are you're also going to want to key your radio from the keyboard. You may wish to omit this portion of the interface if you plan to key the radio as you normally do, such as for VOX operation.

The last enhancement, shown in Figure 4, is a negative voltage supply for the interface, so that you need only one battery or positive supply voltage. This simple circuit has been around in various forms over the years. U2, a 555 timer, oscillates around 1 to 2 kHz at the output of pin 3 on the chip. The network consisting of D8, D9 C3, and C4 comprises a full-wave rectifier circuit to take the place of an external negative supply. You may wish to eliminate the battery and use a 9 V supply, perhaps by bringing in a +9 V to +12 V line from the radio itself.

Table 1. 6-Pin Signal Assignments

6-Pin Din	Signal
1	GND
2	TTL signal from radio
3	TTL signal to radio
4	Key line

An on/off switch completes the interface. It seemed wise to use one section of the switch to disconnect the key line from the interface when it was not in use. If you do bring in the power from the radio, you may wish to eliminate the power switch.

Construction of the Interface

The parts list contains the few components you will need to get the simple or permanent interface operational. Both of them use the Radio Shack Experimenter Socket, which fits snugly down into the Radio Shack Deluxe Project Case.

Well, it almost fits. It's certainly tight enough; no hardware is required to keep it in place. I chose to view this as a blessing, not an "Oh no!" If you wish, you can easily drill the plastic case to mount the LEDs and the power switch. I used the faithful nibbler tool to eat out a three-sided hole in the back panel to mount the RS-232 male connector. The cable from the radio was brought in through a back

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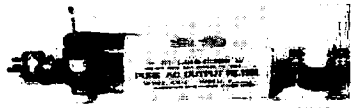

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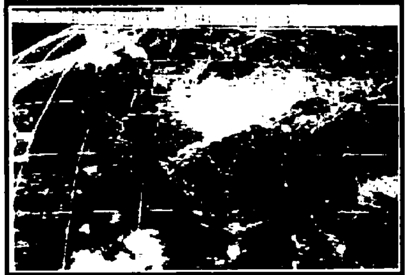

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Table 2. Parts List - Deluxe Interface

Part	Description	Part Number
D1,D3,D5,D7,D8,D9	1N914 diodes	RS 276-1122
Q1	2N2222 (or 2N3904) NPN transistor	
U1	LM324	RS 276-1711
U2	555 timer IC	RS 276-723
S1	DPDT switch	RS 276-636
D2,D4,D6	LED	RS 276-1622
R1	3.3k, ¼W resistor	
R2,R3,R6,R8,R9	100k "	
R4	10k "	
R5	1.5k "	
R7	47 ohm "	
R10	1k "	
R11	4.7k "	
R12	68k "	
R13	22k "	
C1,C2	0.01 µF, 15V ceramic capacitor	
C3,C4	80 µF, 15V electrolytic (or substitute 100 µF, 35V, RS 272-1016)	
Packaging		
1	Experimenter socket	RS 276-175
1	Deluxe project case	RS 270-221
1	6-pin din connector*	RS 274-021
1	DB-25 Subminiature female connector	RS 276-1429

*For FT-980 only. Use radio connector shown in your manual.

Alternative Interface (see Figure 5.)

Qty.	Description	Part Number
1	MAX232 (or ICL232)	Digi-Key ICL232
1	7805 voltage regulator	
3	10 µF, 16V electrolytic (or tantalum) capacitor	
2	4.7 µF, 16V electrolytic (or tantalum) capacitor	
2	0.1 µF ceramic capacitor	
1	DB-25 female connector	RS 276-1429
1	6-pin DIN connector	RS 274-021
1	28-pin accessory jack for FT-980	Yaesu

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NOTE: The GW-BASIC program CAT_SEED shown in this article (Figure 5) is included on this disk. The CAT_SEED program is also available from the *73* BBS under the *73MAG* SIG at (603) 525-4438.

panel hole and held in place on the circuit side with a cable tie.

I found a couple of small capacitors at a street sale to use as C3 and C4. Radio Shack equivalents are listed in the parts list, but I suspect their physical size will not be as pleasing to the eye. That's why they make tops to the boxes.

When all was said and done, there was still room on the back panel to mount a 9 V battery with a rubber band passing through two small holes, then tied off.

The 6-pin DIN connector at the end of the cable is shown for operation of an FT-980 only. You may be talking to another radio, so you will have other pin connections and connector. Check your manual and use Table 1 to wire your configuration. The RS-232 connections are the same for all computers, even non-IBMs. Check your serial port manual to make sure this isn't a lie!

Operation

Operation is straightforward. Except for the on/off power switch, it can be unattended. As your program commands the radio, LED D2 will follow the activity. If your radio responds with echo or status information, as does the FT-980, LED D4 will likewise follow the TTL to RS-232 response. LED D6 lights when the radio is keyed either by the computer or by the radio itself.

Most radios require a 4800 baud rate for computer-to-radio communication. Since we're dealing with a saturated amplifier configuration, the baud rate is of no consequence if it stays within reason. "Reason," of course, is some high baud rate where the circuit frequency response can no longer keep up with the transistion time. I don't know of any radio presently available which should cause concern.

One final note about operating: RFI. When you look at the schematics, you can see that I used no bypass capacitors. You may wish to include 0.001 µF caps across all input and output lines. That's fine, but there's a better solution to computer-generated RFI: toriod traps, like Radio Shack's toroid choke RS 273-104, or those offered by MFJ and other manufacturers. No installation is complete at K5YEF without one of these somewhere in the line of the new gadget. I did a four-turn choke using one of these between the interface and the FT-980 without any noticeable increase in birdies when it's on line.

Testing the Interface

Testing is done with the interface not connected to the computer or the radio, but with the interface battery installed. Use a second 9 V battery to connect the negative terminal to pin 7 of the RS-232 interface connector (ground). Be sure to use a 10k resistor in series with the testing battery in the following steps!

Turn the interface on and touch pin 2 of the RS-232 interface connector. LED D2 should light. If you've included the key line circuit, then touch pin 4, and LED D6 should light.

Now disconnect the test battery; you're through with it. Run a wire to pin 7 of the RS-232 interface connector, and short it to pin 2 on the 6-pin DIN connector. LED D4 should light. Be sure to see Table 1 if you are not using a 6-pin DIN for an FT-980 for this test point.

That's it, you're ready. Turn off the interface and put it in line between your radio and computer.

An Alternative

Most of the parts for the simple and deluxe versions of the interface are available from your neighborhood Radio Shack store. However, if you can obtain a MAX232 IC, a smaller version of the CAT interface can be built. M.G.D. Vermeulen ZS1HQ came up with this design which also takes power directly from the FT-980 accessory socket (no battery needed). If you have difficulty finding the MAX232, you can replace it with a Harris ICL232. The ICL232 is available from Digi-Key, P.O. Box 677, Thief River Falls MN 56701-0677. Phone (800) 344-4539. See Figure 5 for this circuit.

Just the Beginning

This project is not an end unto itself; it is really the beginning. The CAT interface is a door to all the control ideas you have running around inside your head when you bought your radio. It's simple to build, and you can begin experimenting with software (don't let anybody tell you it can't be done in BASIC—they haven't proven that to me yet!). Spread spectrum, maybe?

Design Your Own CAT Program

After you do the simple hardware tests on the Universal CAT Interface, you'll be itching to try your system in the CAT mode. Presented here is a GW-BASIC (Version 3.2) program which I believe you can use to adapt to any CAT equipped radio. "Those are big words, stranger." I know, I know. The big problem is a lack of a CAT standard. If there are two radios with the exact same I/O command set I am unaware of them! I would urge the radio industry to get together and agree on a standard command set for CAT control. But you have to start somewhere and I would like to plant this program which I have put into the Public Domain into your schedule and let you run with it.

It's not going to be easy, but it is relatively simple. You'll understand what I mean if you'll commit to the attempt, and if you will just maintain an I-CAN-DO-IT attitude, take your time and keep trying, you will eventually get the desired results. And I can't describe what a great feeling it is to see the radio respond to your keyboard.

You lucky FT-980 owners can use the program as is. It will come up and capture the radio and display all 148 status bytes from the radio. It will settle on 20 meters, USB, 14.250.000, picked because that is the example in the YAESU manual. Hit <ENTER> and the radio switches to AM and WWV on 10 MHz. Hit <ENTER> again and the radio switches to 10 meter FM and begins a frequency scan from 29.500 to 29.690 ad infinitum. You can interrupt the scan or resume it by hitting any key at any time. The screen displays the frequency too. <F1> exits the program at any point you desire.

The one quirk 980 owners will discover is that it will require two tries to capture the radio the first time. Run the program and after a few seconds do a Ctrl-Break. Then run it again. From then on (unless you turn the radio off) it will run on the first try. Sure, you can add a fix. I had to add one to my Pascal version, but it is beyond the scope of this exercise.

OK, so what if you own a radio other than the FT-980? This program will be a good solid starting point. Oh yes, it will require some knowledge of BASIC, patience and study, but the trek will be worth it. The program has the two main ingredients necessary for CAT activity: a way to output commands and a way to capture data from the radio.

First study your manual and become familiar with the sequencing of events that your radio requires. The FT-980, for example, requires the following:

1. Send a command to the radio.
2. Receive an echo of the command from the radio.
3. Have your software compare the command against the echo. If they are the same, then perform the next step, #4. If not, then start over again at step #1.
4. Send OK-TO-EXECUTE command to the radio.
5. Receive a status stream from the radio to update the changes it just made.

WOW! Well the fact is the FT-980 is one of the more complicated CAT radios ever put on the market. (I give that a plus, not a minus!) Unlike the sequence listed above, your radio may only need to receive a command to change mode or frequency. It may or may not "talk" back to your computer at all. So at this point we can begin to trim down the CAT_SEED program to customize it to your radio. In the following steps when you're advised to "eliminate the following lines" you might wish to simply REMark them out—just in case.

Tailor the Program For Your Particular Radio

1. Eliminate line 2030; it surely just applies to the FT-980.

2. If your radio isn't captured during a CAT session, that is, if it only responds to commands but the front panel controls re-

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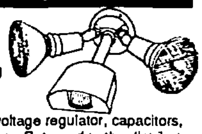

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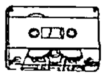

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```
10 '        P U B L I C  D O M A I N  CAT SEED P R O G R A M
15 '*****************************************************************
16 '* This program may be freely distributed and exchanged. It may  *
17 '* be rewritten, modified, changed and/or expanded. Indeed you    *
18 '* are  encouraged to do so to make it work with your particular *
19 '* radio. You need not even give this author any credit. While   *
20 '* this program is originally intended for the YAESU(tm) FT-980  *
21 '* transceiver, a careful approach and rewrite should make it a  *
22 '* seed for the development of most other ham radios on the      *
23 '* market. One request: share your ideas with others. This is an *
24 '* still an exciting frontier of ham radio. On with it!          *
25 '*      (Program prepared at the suggestion of 73 Magazine)      *
26 '*         Art Harding K5YEF, PO Box 1719, Plano, Tx 75074       *
27 '* Full featured FT-980 EXE program available from above address *
28 '*****************************************************************
50 GOSUB 9000 'Set up your computer COM port
60 GOSUB 1000   'INITIALIZATION
70 GOSUB 2000   'Begin CAT action
80 'Release radio and shut down COM port
90 CMD$=ONOFF$:GOSUB 6000
100 PRINT#1,OK$;
110 CLOSE #1
120 PRINT:PRINT:PRINT"Radio released - COM 1 NOW CLOSED -Program complete..."
130 END
1000 '* INITIALIZATION
1010 OPTION BASE 1
1020 DIM ECHO$(5) 'Echo is same length as a command, 5 bytes
1030 DIM STATUS%(148) 'The FT-980 complete status stream, 148 bytes
1040 CMD$="     "   'This could have been a DIM CMD$(5), but this works too..
1060 OK$=CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(&HB)      'OK to execute CMD
1070 ONOFF$=CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)               'ON-OFF CMD
1080 ALLSTATUS$=CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(&H1)  'Status ALL CMD
1085 TIMER1=4000 'Change if trouble with receiving status inputs
1090 TIMER2=1000 'Change for hang time between 10 meter FM freqs
1100 GEN$=CHR$(&H21): HAM$=CHR$(&H22):                 'Choose GENeral or HAM vfo
1110 USB$=CHR$(&H11): AMW$=CHR$(&H14): FM$=CHRS(&H17)          'Some modes choices
1120 MR$=CHR$(&H1E): VFO$=CHR$(&H1F)                         'MEMory or VFO choice
1130 RETURN
2000 '* MAIN PROCESSING
2010 '1)Capture radio 2)Choose VFO 3)Choose HAM/VFO 4)Choose USB 5)Choose freq
2020 CMD$=ONOFF$: R=148: GOSUB 5010   'R is the number of status bytes expected
2030 IF STATUS%(27)=1 THEN PRINT "Radio Is Captured!" ELSE 2020
2040 CHOICE$=VFO$: R=22: GOSUB 5000
2050 CHOICE$=HAM$: R=22: GOSUB 5000
2060 CHOICE$=USB$: R=22: GOSUB 5000
2070 'The next line changes the frequency. You can "read" 142500 reading
2080 'from the next to last byte, right to left.
2090 CMD$=CHR$(0)+CHR$(&H50)+CHR$(&H42)+CHR$(1)+CHR$(&H8): R=5: GOSUB 5010
2100 CMD$=ALLSTATUS$:R=148:GOSUB 5010 'Task radio for a complete status
2110 GOSUB 9100
3000 PRINT:PRINT:PRINT "Hit any key to switch to WWV on 10 MHz (F1=quit)"
3010 GOSUB 9999 'Hang around for next key hit
3020 GOSUB 9200
3030 GOSUB 9100:
3040 PRINT"Compare the 2 status displays now on the screen. Notice the changes."
4000 PRINT: PRINT"Hit any key to scan 10 meter FM frequencies...(F1 to quit)"
4010 GOSUB 9999
4020 GOSUB 9500
4030 RETURN
5000 CMD$=CHR$(0)+CHR$(0)+CHR$(0)+CHOICE$+CHR$(&HA)
5010 ' OUTPUT COMMAND - GET ECHO - COMPARE/CONFIRM - GET STATUS
5020 GOSUB 6000         'Output Command, Get ECHO
5030 GOSUB 7000                 'OK
5040 GOSUB 8000                 'Get status
5050 RETURN
6000 '* OUTPUT COMMAND AND GET ECHO
6010 '*
6020 N=0
6030 COM(1) OFF
6040 PRINT#1,CMD$; 'ALL CAT radios will need to do this!
6050 N=N+1: IF (EOF(1) AND N<TIMER1) THEN 6050 'Wait for input but not forever!
6060 REM IF N>=TIMER1 THEN 7100 'Oh oh, no COM action was detected, try again.
6070 WHILE NOT EOF(1): ECHO$=INPUT$(5,#1): IF LOC(1)=0 THEN 6080:WEND
6080 IF ECHO$=CMD$ THEN RETURN: ELSE PRINT"Echo received does NOT match command!
     [trying again]": GOTO 6020
7000 '* send OK to 980
7010 COM(1) ON 'Prepare Event Trap for expected incoming status stream
7020 PRINT#1,OK$; 'The FT-980 OK CMD - ok to execute last command sent
7030 RETURN
8000 '*Get Status
8010 IF EOF(1) THEN 8010
8020 FOR S=1 TO 4000: IF R=1 THEN 8030: NEXT 'Twittle thumbs loop while trapping
8030 COM(1) OFF 'No more input expected at this time
8040 RETURN
9000 'Set up Com Ports, event trap and F1 key trap
9005 'If you get port errors then increase CS10 to CS100 if you have a fast
9006 'computer. For slow computers (10 MHz down) eliminate CS parameter -
9007 'i.e., just CS with no value. These changes are made on line 9010.
9010 OPEN "COM1:4800,N,8,2,RS,CS10,DS0,BIN" FOR RANDOM AS #1
9020 REM FOR S=1 TO 2000: NEXT 'Allow time for port to settle down????
9030 ON COM(1) GOSUB 10000
9040 COM(1) ON
9050 ON KEY (1) GOSUB 80 'F1 key will release radio, close port and quit
9060 KEY (1) ON
9070 RETURN
9100 'Print all status bytes on screen in Hex...
9110 PRINT:PRINT "STATUS Input in Hex (Compare with your manual):"
9120 FOR S=1 TO 148: PRINT " "HEX$(STATUS%(S));: NEXT S
9130 PRINT:PRINT:PRINT"Bytes 2 thru 5 above yield Frequency: ";
9140 FOR S=2 TO 5: PRINT HEX$(STATUS%(S));:NEXT S
9150 RETURN
9200 'SWITCH TO GENERAL VFO, AM AND WWV ON 10 MHz
9210 CHOICE$=GENS: R=22: GOSUB 5000
```

Listing continues

Figure 6. A universal CAT interface program (CAT_SEED) for IBM compatibles (written in GW-BASIC). This program is available from the author (see the Parts List) or can be downloaded from the 73 BBS under the 73MAG SIG at (603) 525-4438.

Listing continued

```
9220 CHOICE$=AMW$: R=22: GOSUB 5000
9230 CMD$=CHR$(0)+CHR$(0)+CHR$(0)+CHR$(&H1)+CHR$(&H8): R=5: GOSUB 5010
9240 RETURN
9500 'SCAN FOR 10 METER FM ACTIVITY
9510 PRINT: PRINT: PRINT"Hit any key to stop and restart scan (F1 to quit)"
9520 CHOICE$=VFO$: R=22: GOSUB 5000
9530 CHOICE$=HAM$: R=22: GOSUB 5000
9540 CHOICE$=FM$: R=22: GOSUB 5000
9550 TEN$=CHR$(&H95): GOSUB 9580: PRINT
9560 TEN$=CHR$(&H96): GOSUB 9580: PRINT: PRINT"* Complete cycle (F1=quit)"
9570 GOTO 9550 'Keep the loop going forever - or until <F1> hit
9580 FOR Q9=1 TO 10
9590 T=1
9600 READ F
9610 BUMP$=CHR$(F)
9620 CMD$=CHR$(0)+BUMP$+TEN$+CHR$(&H2)+CHR$(&H8): R=5: GOSUB 5010
9630 FOR S9=2 TO 5: PRINT HEX$(STATUS%(S9));:NEXT S9
9640 PRINT" ";
9650 T=T+1: IF(INKEY$="" AND T<TIMER2) THEN 9650
9660 IF T<TIMER2 THEN T=1: GOSUB 9999
9670 NEXT
9680 RESTORE 9700
9690 RETURN
9700 DATA &H0,&H10,&H20,&H30,&H40,&H50,&H60,&H70,&H80,&H90
9999 IF INKEY$="" THEN 9999 ELSE RETURN
10000 'THERE IS A CHARACTER RECEIVED!
10010 WHILE NOT EOF(1):STATUS%(R)=ASC(INPUT$(1,#1)):R=R-1:WEND
10020 RETURN
```

main operational between commands, then you should eliminate the following lines: 90, 1070 and 2020.

3. If your radio does NOT echo the commands you send it, you should eliminate the following lines: 1020, 6050 thru 6080.

4. If your radio does NOT have an OK or EXECUTE-THE-COMMAND type command you should eliminate the following lines: 100, 1060, 5030, 7000 thru 7030.

5. Does your radio send back any information like a status stream or some sort of acknowledgement that the command took effect? If your radio does NOT send back anything, you should eliminate lines: 1030, 1080, 2110, 3030, 5040, 6030, 8000 thru 8040, 9100 thru 9150, and 10000 thru 10020. You may eliminate the variable R and all references to R.

Now the next thing you want to do is study the INITIALIZATION portion of the program, lines 1000 thru 1130. Whatever brand of radio you own it's going to need a command buffer defined in line 1040. The one in our seed program is presently 5 bytes. If you need less or more, change it accordingly. A 6 byte command would appear as CMD$="   " (that was six spaces) or perhaps even better, use DIM CMD$(6).

Other FT-980 commands are part of the initialization subroutine such as the command for VFO, USB, etc. Simply substitute commands required by your radio. If there is no substitution in some cases then eliminate that particular one and any other reference to it you may find in the program. After you get this program working then you can add the complete command set.

If your radio does receive status then be sure line 1030 is configured correctly. It is now 148 bytes, the maximum number of bytes the FT-980 radio will send to the computer at any one time. You should make it as large as the number of bytes your manual shows is the maximum you may receive from your radio.

What's left? One of the most important things: setting up the COM port for your particular needs. Let's look at line 9010:
OPEN "COM1:4800,N,8,2,RS,CS10,DS, BIN" FOR RANDOM AS #1.

Check your GW-BASIC manual and your radio manual; make sure these parameters are correct. More than one program I've seen was "bad" because the author used one stop bit. Why not? The rest of the world uses one stop bit—but not the FT-980 PROM. It demands two! So make sure all is OK. The parameter 10 associated with CS above will most likely have to drop to zero if you are using a slow computer and a value higher than 10 for faster machines. I have tested the program at 4.77 MHz on a laptop (CS0) and at 16 MHz on a 386 machine (CS10). One other comment on the port: you may also use COM2 instead of COM1. If you wish to do this be sure to change all COM references throughout the program.

As you work with the program I recommend that you just concentrate on getting the computer/radio dialog going with consistent results. Then you can open up your imagination and add the bells and whistles. Today, my CAT980 program (available as shareware) has some pretty fancy displays, like filter plots, analog dials and user menus for instant deployment. Even a log is included which automatically records all the radio parameters of the moment. But there was a time when the program just sat there and did nothing.

So with that in mind here is one last thought: share your basic ideas with other hams. Write an article or submit a listing to the technical correspondence sections of our magazines. Put your program on BBS's like CompuServe. And if you feel like you've got a program for the big leagues, then enter the world of Shareware. The real fun, and I believe this strongly, is still out there.

There's a barely scratched world of controlled excitement waiting to take shape, and like a lot of things in ham radio, we can have more fun if we keep each other informed. These pages and this interface are a good place to start. ■

Contact Art Harding K5YEF at P.O. BOX 861719, Plano TX 75074. Please enclose an SASE.

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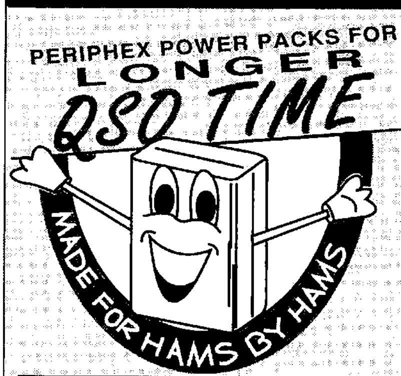

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CIRCLE 68 ON READER SERVICE CARD

73 Review

by Dick Goodman WA3USG

The Kantronics KTU Telemetry Unit with Weathernode EPROM

Remote weather observations via packet!

Kantronics
1202 E. 23rd St.
Lawrence KS 66046
(913) 842-7745
Price Class: KTU—$300
Options: Anemometer—$110
Rain gauge—$ 90

Packet radio is the most rapidly growing and diverse mode in the history of amateur radio! In the early 1980s, the "Packet Revolution" was started by dedicated groups of amateurs in both Canada and the USA. These amateurs stimulated packet growth by setting standards and protocols, offering the first TNCs in kit form at a price affordable to amateurs and, perhaps most importantly, providing much needed information on this fledgling mode. As the years progressed, packet technology accelerated at an exponential rate.

Packet research and development, until recently, has been in the direction of increasing pure communications capabilities. There is another aspect of packet that is finally receiving attention, and that is data acquisition and control.

While communications, BBS usage, message handling and related applications will always be the mainstay of packet, automatic collection and forwarding of data will become widespread in the upcoming years. Wouldn't it be nice to have access to weather conditions at your club site via packet? Parameters such as temperature, wind speed, direction, and even rainfall could be valuable prior to starting an antenna work party. What about the condition of your club's repeater? Knowing the repeater's PA stage heat-sink temperature, PA current, line and Vcc voltages, and AGC voltage, could be most helpful to control operators. How about remote control of equipment? The capability to power down, energize, or reset various devices might be beneficial. Again, as with the "communications" aspect of packet, experimenters have been doing this for years, but until recently there has been no turnkey system to make this possible for the less technically orientated.

Data Acquisition and Control with the KTU

The Kantronics Telemetry Unit (KTU) with the Weathernode EPROM makes these functions possible. The KTU is a small device, 1.75" x 6" x 8", designated as Data Terminal Equipment (DTE). It simply plugs into your existing TNC where your computer (orterminal) would normally be connected. Your computer is then plugged into the rear of the KTU.

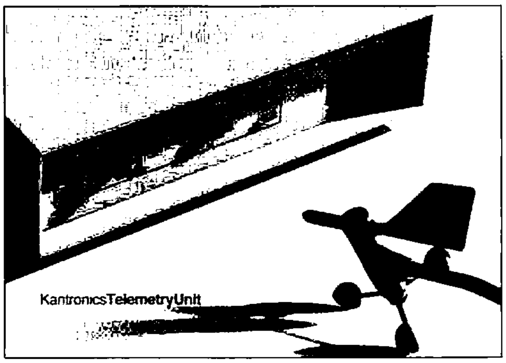

Photo. The Kantronics KTU Telemetry Unit.

The power requirements are 11-20 VDC at 45 mA or, in the "Low Power" mode, 11-28 VDC at 30 mA. The KTU front panel is laid out quite simply. There is a power switch and a power indicator LED. Next to that, a "Telemetry/Local" switch and two LEDs show which position that switch is in. Finally there is a "Bypass" switch and companion indicator LED.

The KTU rear panel consists of a standard DB-25 connector for your computer or terminal, a modular style connector that connects to your TNC (cable and mating connector are supplied), and an 8-pin external sensor connector (cable and mating connector are supplied). Note that normal packet operation is not affected by the KTU; pressing the "Bypass" switch connects the terminal to the TNC and takes the KTU out of line.

Since the KTU includes the Weathernode EPROM, I got the optional anemometer/wind direction indicator. This unit, which includes mounting hardware, is of high quality plastic construction and requires minimal assembly. It's not necessary to calibrate the wind speed portion of the instrument; the wind direction sensor is calibrated with just a compass. Ensure that the instrument is mounted outside as high as possible, and away from obstructions, in order to obtain accurate readings. Both this unit and the external temperature sensor (included with the KTU) connect to the 8-pin connector on the rear of the KTU.

The serial cable from the computer should be connected to the DB-25 connector on the rear of the KTU, and the TNC connected to the KTU via the modular cable provided. These levels may be either RS-232 or TTL, set by internal jumpers in the KTU. If any cables have to be made up, pinouts for all connectors are adequately detailed in the documentation. Once these connections are made, the KTU may be powered up and initialized for operation with your TNC.

Set-Up and Configuration

Set your communications terminal for 8 data bits and the baud rate to match the TNC to the computer baud rate. Set the KTU "Bypass" and "Telemetry/Local" switches to "OUT," then apply power. The KTU will sign on your terminal with its autobaud routine and sign-on message. You will be prompted to enter the date and time.

Once this is completed, operational parameters may be set. These parameters are similar to those used in your TNC (e.g.: abaud, flow, echo, parity, xflow, etc.). The KTU will be optimized in this process to communicate with your TNC. Once the KTU is initialized, some TNC parameters will probably have to be modified. Those options are adequately explained in the documentation.

Once these steps are completed, the KTU is ready for programming. Programming the KTU instructs the unit on how often to sample the external sensors, how to display the results (metric/USA), how many entries to send in response to a data command, and how many entries may be stored in the KTU's inter-

nal memory. Sensors may be sampled and displayed in a range of time from seconds to months. This versatility is quite impressive! The documentation goes into considerable detail on proper syntax and procedures. The KTU may be configured to operate with a variety of TNCs and is compatible with virtually all packet LAN configurations. The KTU may be programmed in a local mode directly from the terminal connected to it, or from over the air. Over-the-air programming requires entry of a password and other unique security constraints.

Using the KTU to obtain weather data is quite simple after reading the user instructions. These instructions are formatted to allow the KTU owner to simply photocopy both sides of one page in the KTU system manual and pass it along to potential users.

On-Line with the KTU

The TNC used for this review was the Kantronics KPC-4. By issuing a connect request to my station a user receives the normal "Connected to" response followed by a "wxn:" prompt. At this point the KTU may be queried for weather data, or programmed by the "Sysop." By simply typing a "D" for (D)ata, the KTU will display the last reading of wind speed, direction, external temperature, and internal KTU PC board temperature (see Figure 1). If the optional rain gauge sensor is installed, this data will also be presented. By entering the correct command, USA or Metric units may be specified. The data command may be modified to request virtually any number of entries from those stored internally.

An example of the data command syntax is: "Data TF 3 WS 5 WD 2"—This would display three readings of external temperature, five readings of wind speed, and two readings of wind direction. Entering the command "PR," displays how the data is being stored. An example of a reply to a "PR" request might be:

"PROGRAM R10M TP TF A15S WD WS
7813 Samples 1 Day 08:00:00."

This response to the "PR" command would tell the user that the internal and external temperatures are being sampled and recorded once every 10 minutes and the wind speed and direction are being averaged and recorded once every 15 seconds. The second line displays the capacity of the KTU's internal memory buffers in this data configuration. In this case, the buffers will store one day and eight hours of data before the earliest information is overwritten. Knowing this, the user can request data in a format useful to their application. If the outdoor temperature is being saved every 10 minutes, the user may not want every reading. Entering a data command of "Data TF 20 3" would display every third reading of temperature for 20 readings (or 20 readings in half-hour steps). All data read with the "Data" command is date and time stamped by the KTU (see Figure 2).

As you can see, by judicious use of programming, the Sysop can save data over long periods of time by keeping the sampling rate low. This would be efficient for day-to-day weather data collection. However, during unique weather phenomenon, the sampling rate may be increased on all sensors to allow instantaneous response to changing temperatures, wind speed, direction, and rainfall. This would be excellent for recording the passage of storm fronts and the like. With this simple, yet versatile data gathering language, the user may request data from any sensor as little or as often as desired.

Other Capabilities

The KTU will support up to seven sensors attached to the rear panel inputs. Each of these sensors accepts a 0–5 VDC input. These inputs are those that are presently being accessed by the Weathernode EPROM. Depending on how the KTU is configured (with internal jumpers), certain rear panel connections may also be programmed to output digital levels (0 and 5 VDC). These connections may also be commanded to generate pulses with the frequency being determined by the user via the "FØ" or "F1" command. This capability would be excellent for controlling remote devices. All this is explained in the KTU system manual. This sophisticated data acquisition mode may not be used in conjunction with the Weathernode, since the weather sensors use all rear panel inputs.

Observations

The KTU did absolutely everything that it was advertised to do. I was impressed with the ease of assembly of the weather instruments and their quality. The anemometer tracks what my existing Heathkit unit displays to within about five percent. The wind direction indicator provides resolution down to single degree units and displays this data in both heading and compass rose notation (e.g.: N, NE, ENE, etc.). The external temperature sensor comes with about 50 feet of connecting cable, as does the anemometer. It is also possible to add additional cable without affecting the calibration of the unit.

The KTU itself is small and has minimal power requirements. I thought that since the internal temperature sensor was located inside the KTU it would indicate considerably higher temperatures than ambient due to component heating. This is not the case, due to the low current requirement of the KTU. The internal temperature displayed by the KTU is within a degree or two of the actual air temperature.

Finally, it took me no more then one hour to get everything fully operational (and that's from the time I opened the two boxes that the units were shipped in). The Kantronics firmware in the KTU operated flawlessly. The flexibility in the way weather data may be captured and presented should meet the requirements of the most demanding amateur and professional meteorologists. The only room for improvement I could suggest is that memory slots be made available for high and low temperatures and peak wind speeds. This data may be derived from the stored weather data, however.

With the development of additional EPROMS, telemetry and data acquisition from a wide variety of applications will be possible. Kantronics has effectively entered a new era in packet technology with this innovative product! ■

```
wxn: d

06/16/91  18:19:54 TPCB= +0079.1 DEGF
06/16/91  18:19:54 TF  = +0083.3 DEGF
06/16/91  21:32:28 WS  = 00012 MPH
06/16/91  21:32:28 WD  = 00268 DEG  *
```

Figure 1. Response to the data retrieve command, "D". Current readings for all attached sensors are displayed. TPCB = PC board temperature, TF = external temperature (deg. F.), WS = wind speed, and WD = wind direction.

```
wxn: d tf 20

06/16/91  18:19:54 TF  = +0083.3 DEGF
06/16/91  18:14:54 TF  = +0083.3 DEGF
06/16/91  18:09:54 TF  = +0083.3 DEGF
06/16/91  18:04:54 TF  = +0083.8 DEGF
06/16/91  17:59:54 TF  = +0084.8 DEGF
06/16/91  17:54:54 TF  = +0084.8 DEGF
06/16/91  17:49:54 TF  = +0084.8 DEGF
06/16/91  17:44:54 TF  = +0084.8 DEGF
06/16/91  17:39:54 TF  = +0084.8 DEGF
06/16/91  17:34:54 TF  = +0085.0 DEGF
06/16/91  17:29:54 TF  = +0085.0 DEGF
06/16/91  17:24:54 TF  = +0085.0 DEGF
06/16/91  17:19:54 TF  = +0085.3 DEGF
06/16/91  17:14:54 TF  = +0085.3 DEGF
06/16/91  17:09:54 TF  = +0085.3 DEGF
06/16/91  17:04:54 TF  = +0085.3 DEGF
06/16/91  16:59:54 TF  = +0085.8 DEGF
06/16/91  16:54:54 TF  = +0085.8 DEGF
06/16/91  16:49:54 TF  = +0085.8 DEGF
06/16/91  16:44:54 TF  = +0085.8 DEGF
```

Figure 2. Issuing a "TF20" command displays the last twenty external temperature readings.

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Hope for Monolingual Hams

If you really want to communicate!

by David Cowhig WA1LBP

Most hams on or orbiting this planet do not speak English as their first language. *The Radio Amateur's Conversation Guide*, written by Jukka OH1BR and Miika OH2BAD Heikinheimo, with the help of ham native speakers, teaches monolingual hams how to get their tongues into acceptable shape for foreign ears. The second edition, published in 1985, includes English, German, French, Italian, Spanish, Portuguese, Russian (in Cyrillic and phonetic script), and Japanese (romanized). Hour-long cassette tapes made by ham native speakers cover these languages, plus Swedish and Finnish.

Supplements to the *Guide* introduce you to Finnish, Danish, Dutch and Serbo-Croatian. Phonetic guides and number lists are followed by 50 pages of phrases in each of the eight languages of the *Guide*. In the 30-page multilingual glossary at the back of the book, you can look up the equivalent of English words commonly used by hams in seven other languages.

The phrases give you all you need to conduct a very basic QSO (contact), describe your equipment, complain about the other guy's splatter, inquire into the other operator's marital status (an important question for international radio romances), and ask for a QSL card. Next time a Japanese station QRMs (interferes with) your long rag-chew on 160 meters, you can tell her "Shuhatsu-o tsukatteimasu!" If the offending OM (male ham) is in Moscow, you might say, "Castata zanjata!" If you want to ask a Russian to give you a call next time he hears you, why, just say, "Kagdá byi vyi ni uslýisali minjá pazálsta, vizavítje minjá" (and don't forget the accent marks).

Some You Have to Hear

Language tapes are necessary for those languages which English-speaking people find hard to pronounce. Japanese pronunciation is fairly easy and regular. You could probably make yourself understood in Japanese without the tape if the authors would explain the phonetic systems they use. Romanization is used for Japanese and Russian, but the conventional spelling of languages written in the roman alphabet is given. Just a list of the kana syllabary used to write Japanese would help readers pick out the pronunciation much more easily. The standard romanization of Japanese used in the *Guide* can mislead. For example "five years," *gonenkan*, is pronounced "go-nen-kan," not "gon-en-kan."

A one-hour tape of any language in the *Guide* costs $9.95 plus shipping. Text supplements cost $1.75 per language. You can order *The Radio Amateur's Conversation Guide*, by Jukka and Miika Heikinheimo, from *CQ Communications*, Main St., Greenville, NH 03048. Tel. (800) 457-7373. The price is $9.95 plus $3.75 postage.

Spanish and Russian

"Hola CQ," by "Doc" Schwartzbard AF2Y, gives you all the sentence patterns and vocabulary you need to carry out a basic QSO in Spanish. Many hams who took high school Spanish will find that the sentence patterns come back. Their new ham vocabulary also makes them want to learn more Spanish by radio.

The ARRL's "Hola CQ" consists of fine Spanish lessons for hams. A 90-minute cassette tape accompanying the text teaches the basics of Spanish pronunciation as well as the pronounciation of each phrase in the text. AF2Y reminds us of the many words Spanish shares with English and other romance languages, and how recognizing these words will speed our progress. You can get "Hola CQ" from the ARRL, 225 Main St., Newington CT 06111. It costs $7 plus postage.

Once you have mastered some phrases in your chosen language, you might try to find a night course at a local high school or junior college. You could also pick up a first-year college textbook on the language to get a systematic introduction to vocabulary and grammar. With your access to on-the-air tutoring, you may become an outstanding ham linguist.

Russian and Japanese in Particular

Other language lessons for hams are available. Len Traubman, with the help of some Russian hams, wrote "Russian Phrases for Amateur Radio," a 20-page booklet. The accompanying audio cassette tape is for English-speaking hams who want to communicate in Russian. The booklet contains English words and phrases for ham contacts, with Russian translation and transliteration for each phrase. You can get the booklet for $5 ($7 overseas) and the audio cassette for $6 ($8 overseas) from Len Traubman W6HJK, 1448 Cedarwood Drive, San Mateo CA 94403.

You can also download "Japanese for Hams," a 12-page guide I have written on making simple QSOs in Japanese, free from the *73* landline BBS (603) 525-4438; or from JAHAM in the files section of the N4QQ packet BBS. Call K3AF-7 in Washington, DC on 28.195 MHz 1200 baud, connect to K3AF-3, and then to N4QQ.

Goh Kawai 7L1FQE/N6UOK, a linguistics scholar at Stanford University, is working on a text of Japanese lessons for hams. You can contact him at CompuServe 76056,1726. If you get more serious about learning Japanese, you can order *Japanese for Beginners* and *Japanese for Today*, edited by Yasuo Yasuda, and published by Gakken, from Kinokuniya, 10 West 49th St., New York NY or from some other bookstore. Tapes accompany the text.

After you have worked on Japanese for awhile, you will find reading articles in *CQ Ham Radio*, the wonderful telephone-book-size (!!!) ham magazine from Japan, a great incentive to improve your Japanese. You can order *CQ Ham Radio* through Nihon IPS, Iidabashi 3-11-6, Chiyoda-ku, Tokyo 102 JAPAN for about $120 per year. You may be able to order single copies of it, or of its more technical cousin *Ham Journal*.

As the karatkavalnaviks (hams) say back in the U.S.S.R., "Zeláju vam udáci i mnóga di-eks": I wish you good luck and lots of DX. 73

David Cowhig has translated articles in Japanese for us and written articles on ham radio in Japan.

QRP

Low Power Operation

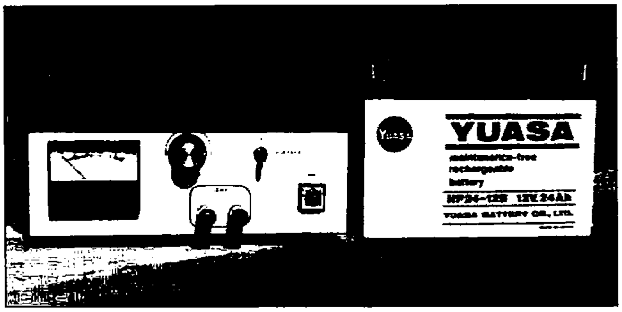


Photo A. The pulse charger—upgraded to handle larger batteries.

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The Pulse Charger

The use of batteries in portable QRP operation captivates the attention of a lot of people. In the August 1989 column, I discussed a small pulse charger for Gell/Cell™ batteries. This project produced huge piles of mail. The original circuit has been changed slightly, to improve switching, and a PC board is now available to speed construction.

Perhaps a quick review of the circuit is in order. The Gell/Cell battery is charged using high current pulses, rather than a constant current. High current pulses won't heat up the battery, which reduces the chance of damage.

Operation is simple. A 555 timer operating as an astable oscillator provides adjustable pulses to an IC voltage regulator. The duty cycle of the oscillator may be varied by the front panel 50k pot. This control adjusts the current to the battery by varying the pulse width from the 555 oscillator. The output of the 555 is coupled to the base of the 2N2222 transistor via a 1N914 diode. This diode protects the 555 just in case the LM317 goes out to lunch and takes the 2N2222 with it for company.

When the output of the 555 timer goes high, the transistor is turned on. This shorts out the ADJ line of the LM317, shutting it off. Thus, no current will go to the battery. When the 555 timer is off, so is the transistor, allowing the LM317 to operate at the voltage selected by one of the 5k trimmers. In a nutshell, when the 555 is on, the LM317 is off.

The 5k trimmers set the state-of-charge for the battery. For cycle use, a Gell/Cell battery should have a full state-of-charge voltage of 14.4 volts. For standby use, select 14.0 as a full state-of-charge voltage. I also have a handful of 6 volt gelled batteries I use now and then. So, the second voltage I selected is 7.2 volts.

NiCds

A note about NiCds before we get too far into this project. When this charger first came out, many of you asked about charging up HT batteries. Well, you can—*if* you understand some of the limits of both the charger and the NiCds. First and foremost, HT batteries are all different. Batteries that came with the HT and those you have replaced from a third-party vendor may be different. In most cases they *are* different.

I know of one particular battery pack that does some magic when dropped into the manufacturer's quick charger. The battery pack is normally 12 volts, but a small relay inside the battery pack switches the batteries to a 6 volt configuration to allow high speed charging. To keep things from blowing up, a heat sensor glued to one of the cell's case will open up, stopping the charge current until the cell has cooled down. Some third-party battery re-fitters don't include this sensor. How many of us, in repairing an HT battery pack, have removed the sensor?

If you use the pulse charger to charge up the NiCds for your HT, limit the current to whatever value is listed on the battery's charge table. After you get the feel of things, you can increase the current.

Construction is very easy, thanks to the circuit board supplied by Far Circuits. Not knowing what everyone has in the junk box, I laid the PC board out to use several different styles of the LM317 and diode bridge. Use whatever version of LM317 you have, either in the TO-220 case or the TO-3 case style; BUT NOT BOTH AT THE SAME TIME. The same goes for the diode bridge. You can use either four individual diodes or a bridge rectifier pack from Radio Shack (RS 276-1146), but not both. I prefer the Radio Shack part myself; it's easier to install on the board.

The filter capacitor is also mounted on the PC board this time. A 2200 µF capacitor is used. This value is not especially essential; you can use as low a value as 1000 µF and as high a value as 10,000 µF. The filter smooths out the DC from the bridge so the 555 timer sees a nice smooth Vcc. The 78L12 provides a regulated +12 for the 555 timer. Don't forget to use the bypass capacitors on the 78L12.

Keeping it Cool

The LM317 can get kinda hot. In my prototype, it got too hot. (How hot did it get, Mike?) It got so hot the black heat sink turned silver! It was my fault. I was charging up 24 amp/hour batteries. This was way too much current for the one amp LM317 to pass. I was really surprised that it didn't fry the LM317! One way of generating too much heat is over-sizing the transformer. For 12 volt charging, use only an 18 volt trans-

Parts List for the Pulse Charger

Part	Description
U1	78L12 voltage regulator
U2	555 timer IC
U3	LM317K (or LM317T) adjustable regulator
Q1	2N2222 NPN transistor
D1–D4	1N4001 (or bridge rectifier RS# 276-1146)
D7	1N4001
D5,D6	1N914 diode
C1	2200 µF, 35 V electrolytic, axial
C2,C3	2.2 µF, 35V tantalum
C4,C7	4.7 µF, 35V tantalum
C5,C6	0.1 µF ceramic
R1,R3,R4	2.2k, ¼W resistor
R2	50k potentiometer
R5	220 ohm, ¼W resistor
R6,R7	5k potentiometer
T1	18V at 2A AC transformer

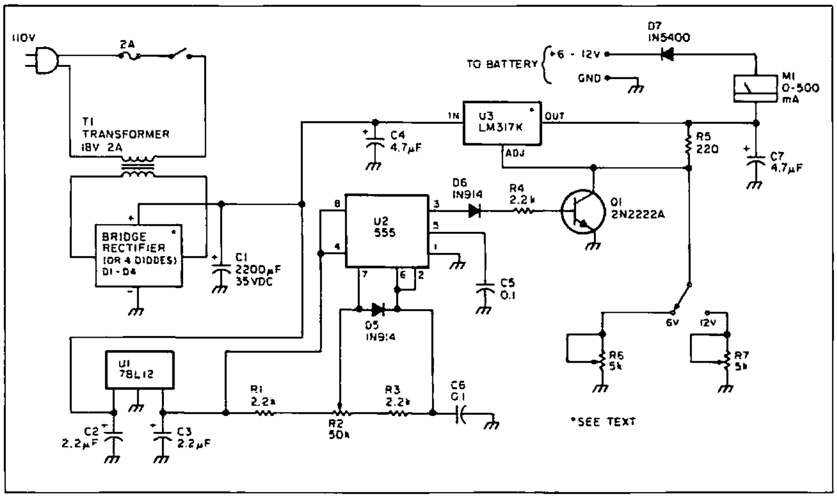


Figure 1. Schematic for the pulse charger.

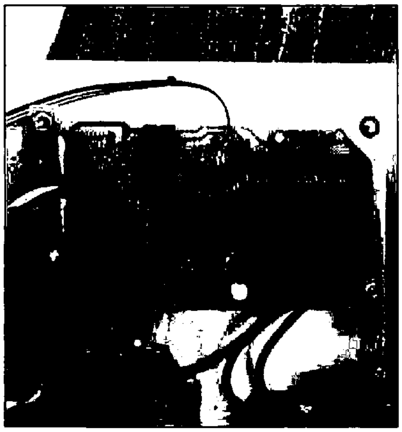


Photo B. Prototype PC board used in charger. Note the extra resistor soldered to the capacitor. Now the resistor is on the board. Just under the larger capacitor, the LM317 is bolted to the metal chassis.

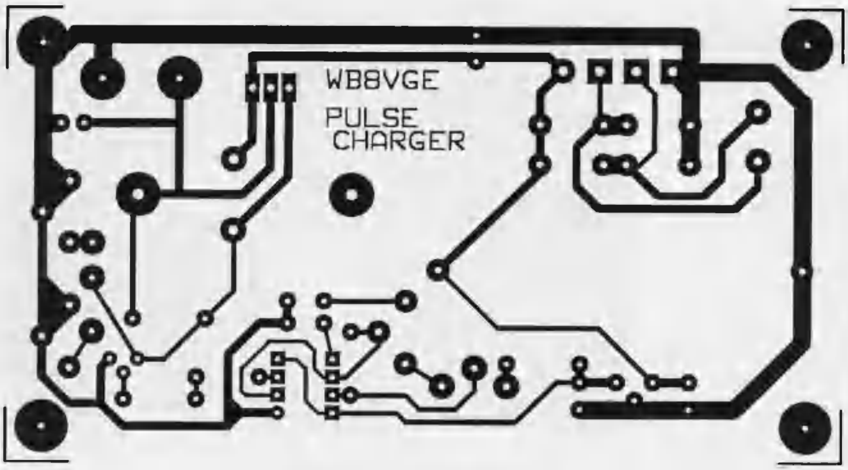


Figure 2. PC board foil pattern.

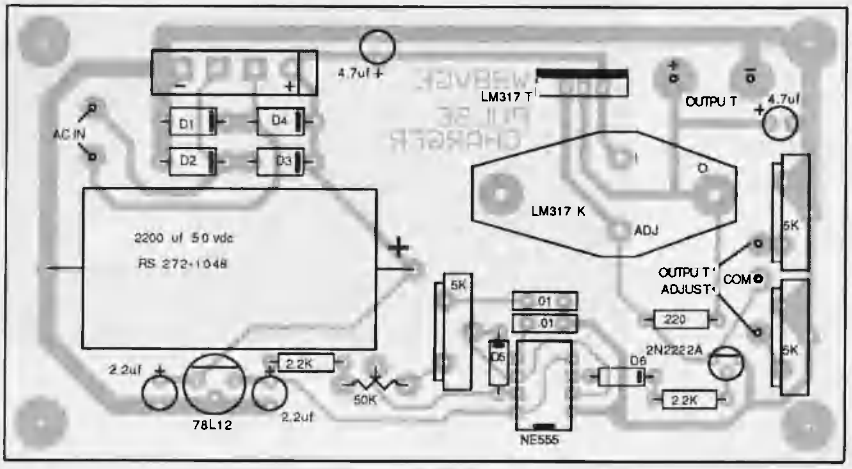


Figure 3. Parts placement.

former, no more. If you regularly charge HT batteries or 6 volt gells, a 12 volt transformer will do just fine.

If you want to charge larger batteries, use the LM350K. This device is good for 3 amps of current. In any case, to keep your charger from becoming your own personal Three Mile Island, you have to heat-sink the LM317. If you use the TO-220 case, you have an easy option. Just use the metal chassis as a heat sink. You have to insulate the case from the chassis, as it is hot. Radio Shack sells a mounting kit for the TO-220 for a buck.

If you go this route, use 1/4-inch spacers for the board, and solder the leads of the LM317 from the foil side of the board. Bend the LM317 back down so it will lay flat against the chassis. Spread some heat-sink compound on both the LM317 and the chassis to improve heat transfer. Don't forget to insolate the LM317 from the chassis. Pre-fit everything before you drill holes into the chassis.

Another option is to use the TO-3 case, LM317. The PC board is big enough to hold it and a heat sink. Because there are many different styles of heat sinks on the market, it's a good idea to make a dry run to be sure everything fits before soldering.

Easy Set-Up

Remove the 555 timer and lay it aside. Apply power to the circuit. Check for +12 volts at pins 8 and 4 of the 555. Select one of the trimmers. Set it for 14.4 volts. Set the other for 7.2 volts. Again, you can set these for whatever value you want or need. If you use the blocking diode, set the voltage on the battery side of the diode. This blocking diode is not on the PC board. You really don't need it, but if you're like me and forget to disconnect the battery and to power down the charger, the battery will discharge into the charger. The diode prevents this from happening.

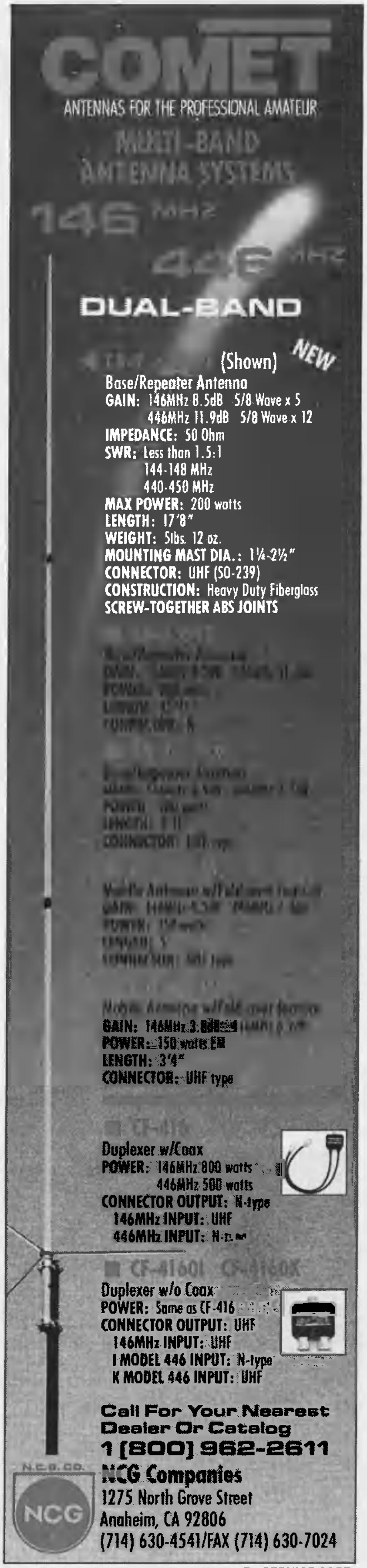
In the prototype, I used a 0–500 mA meter. I found this to be too small for the batteries I was charging. Use a 0–1 amp meter if you plan on charging 4.5 amp/hour or larger batteries.

Power down the charge and let the caps discharge. Replace the 555 timer. With a battery connected to the output, power up the charger. With the duty cycle control, set the current for proper charging. Remember, the meter will average out the reading from the pulses going to the battery. That's about all there is to do. When the battery becomes fully charged, the current will drop to a very low reading. How much current is flowing when the battery is fully charged depends on the type of battery, battery size, and of course, the battery temperature. Don't use the charger to operate any of your gear!!

Kit Available

To make it easier to get this project going, I can supply a complete kit of parts for the charger. The kit will contain all of the PC board components. There won't be too many of these kitted up, so don't wait too long. Cost of the PC board and parts is $29.95, plus $2.50 for postage.

That should take care of all your portable batteries. No reason to not pick up the HW-9 and head for the woods. Ah yes, QRP; better living with less. 73



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The Dayton Youth Forum

For several months prior to the 1991 Dayton Hamvention, I was concerned about finding dynamic youngsters who were also active hams to speak at the Youth Forum I was going to be moderating there. I was also anxious about how many hams would be bringing their own youngsters with them to the Forum, as we had been publicizing and advertising in all the ham magazines.

Happily, all anxieties were for naught. The Youth Forum got off to a flying start when astronaut Tony England WØORE stopped by to wish us well, and offered to speak to the standing-room-only audience.

Dr. England was appointed a NASA scientist-astronaut in 1967, and acted as mission scientist for the *Apollo* 13 and 16 flights. He also flew as a mission specialist on the space shuttle *Challenger's* Spacelab 2 mission in 1985. Currently, he is professor of electrical engineering and computer science at the University of Michigan in Ann Arbor. There he both teaches and conducts research on microwave emission, propagation, and scattering.

Tony England enchanted everyone with his stories of how he and his high school ham friends used their knowledge of Morse code to better "communicate" during tests. The audience of more than 60 youngsters, plus all the adults who attended, were privileged to hear Tony speak of his interest in amateur radio as a vehicle to interest young people in science and engineering. With few and progressively fewer bona fide role models for young people in today's society, Tony England made a superb opening speaker for the 1991 Youth Forum at Dayton.

Dynamic Speakers

After such an auspicious introduction, the young speakers had no problem picking up the ball and impressing the audience with their eloquence, composure, and dedication to amateur radio.

The first young speaker on the agenda was Todd Tittle KF7LX from Sedro-Woolley, Washington. This personable 17-year-old is an Advanced Class license holder and president of his high school amateur radio club. Todd was secretary and treasurer of the Western Country Cousins Net, for which he also served as net control. His apparent ease at the microphone at a national convention spoke well for his experiences at the radio over the last several years. Todd attributed his original interest in ham radio to his grandfather. He encouraged the young people who were present to pursue different areas of the hobby and have fun with it.

Willis Almekinder KB2LEP is a 15-year-old ninth grader from Lyons, New York. Despite his young age, Willis is a member of RACES, and has used his New York Disaster Preparedness Commission identification card to get past road blocks and into the center of emergencies to offer assistance. He has already made a career choice that will take advantage of his outgoing demeanor. Willis wants to combine an extensive electronics knowledge with an interest in law, and to argue cases that involve high technology. Willis encouraged the youngsters in the audience to consider getting involved with emergency preparedness in their local areas.

Sammy Garrett AAØCR was next at the podium. This articulate 13-year-old from Florissant, Missouri, has an Extra Class license. Sammy and I spent some time together talking at the convention leaving no doubt in my mind about why he was selected the 1991 Westlink Young Ham of the Year. He amazed the audience with his aplomb, and encouraged the adults to share their enthusiasm with the youngsters they wanted to recruit into ham radio. Sammy suggested that we all look for the "little child" in ourselves when speaking to young people. He made an enormously favorable impression on everyone.

Photo A. Astroham Tony England WØORE got things off to a flying start with Carole Perry WB2MGP at the Dayton Youth Forum.

Photo B. Sammy Garrett AAØCR, the Westlink Young Ham of the Year, encouraging adults to share their enthusiasm with youngsters.

Photo C. Lenny Mack KB8KTC participated in Moonbase America.

Brian Cresenzi KB2GTD, a 14-year-old from Ryebrook, New York, shared his experiences as SAREX (Shuttle Amateur Radio Experiment) net control at Blindbrook High School, New York, for the STS-35 mission last December. Brian made the initial contact that gave students at his school a chance to ask questions of Ron Parise WA4SIR, payload specialist on board the *Columbia*. Brian and his dad, KB2GTE, are members of the Westchester Emergency Communications Association. Someone in the audience commented to me on how wonderful it was for young people to be playing such an active role in some of the most extraordinary events in the world today. Amateur radio has provided an unparalled opportunity for children to become motivated about tomorrow's possibilities in technology.

Lenny Mack KB8KTC is a tenth grader who had the incredible experience of participating in the Moonbase America project during the third week of April 1991. Moonbase America is a national educational project created in conjunction with NASA. Project headquarters is in the Copely-Fairlawn City Schools in Copely, Ohio. Lenny explained that the project is a simulated moon-station constructed out of geodesic domes. Moonbase, designed to provide a lunar environment where students could study science, was located beside the tennis courts of Copely High School. As a command controller, Lenny described how ham radio played a major role in the communications setup of this course for teaching students how to live on the moon, and to appreciate the value of teamwork and individualization. *[See the April "QRX" for more details about Moonbase America.–Eds.]*

All Hopes Fulfilled

I hope never to conduct a youth forum that doesn't include at least one distaff member. Through the generosity of several hams, **Mary Alestra KB2IGG**, a 13-year-old from my class, was able to attend Dayton and speak at the forum. This Extra Class license holder was the 1990 Westlink Young Ham of the Year. She has gone on to be an inspiration for many other young people, especially girls.

It was my profound hope when we began this that the Youth Forum would showcase young people who were accomplished, involved, and having fun in amateur radio. It was a personal honor to be able to bring together such an outstanding representation from across the country. It was clear to anyone in attendance that day that at least some of the not-yet-ham children attending the forum will be considering the possibility of joining our ranks.

Thanks must go to the members of DARA who are always so supportive of educational efforts, and to everyone in the ham community who encourages and lends support to youth-oriented activities, thereby ensuring continued recruitment of bright, energetic, and dedicated young people.

Number 15 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

AMSAT at Dayton 1991

If you haven't made the trip to the Dayton Hamvention at least once, plan now to attend next year. Over 30,000 hams were on hand for a ham radio convention of gigantic proportions. I thought the Houston gathering was large and the one from Dallas huge, but both paled before the massive assembly of commercial exhibitors, presentations, swapfest enthusiasts and ham participants that took over southwestern Ohio for a long weekend in April.

The event organizers outdid themselves with quick registration, shuttle buses to outlying parking areas and talk-in information on 2 meters, 220 MHz and 70 cm. The convention guide was a full-sized magazine, not just the simple forum list so common at other ham conferences.

AMSAT was well represented with speakers in the meeting rooms and informed volunteers at the booth in the commercial exhibit area. Most of the AMSAT board members and officers attended and were available at the Hamvention to answer questions about the amateur radio satellite program.

AMSAT President and General Manager Doug Loughmiller KO5I spoke at a forum about the successful launches of several new hamsats in 1990. Lou McFadin W5DID and AMSAT Director Tom Clark W3IWI described the Shuttle Amateur Radio Experiment (SAREX) equipment used on board STS-35 and STS-37. Lou showed a tape of amateur television video as received by Ken Cameron KB5AWP on the recent STS-37 mission. Dr. Tony England WØORE, who took ham radio to space on a shuttle mission several years ago, spoke on the educational benefits of the SAREX operations.

AMSAT Director and Vice President of Manned Spacecraft Operations Bill Tynan W3XO touched on future shuttle and space-station activities, while AMSAT Director Dr. Bob McGwier N4HY discussed the Microsat programs under consideration or construction in several international locations including Mexico, Australia and Italy.

Back at the AMSAT booth, in addition to the excellent advice and help offered by the volunteers, AMSAT had new publications for sale. *Decoding Telemetry from the Amateur Satellites* by G. Gould Smith WA4SXM provides an in-depth look at all the current hamsat telemetry schemes from the simplest CW on AMSAT-OSCAR-21, to the complexities of the University of Surrey satellite systems.

The Satellite Experimenter's Handbook has been completely revised by author Marty Davidoff K2UBC. The result is an updated and expanded reference book for both beginners and longtime hamsat enthusiasts. Although the price is up to $20, this 350-page volume covers all the bases when it comes to satellite chasing.

A Beginner's Guide to OSCAR-13 by Keith Berglund WB5ZDP is into another print run. AMSAT ordered a large batch of these popular booklets to be ready in time for Dayton and for potential sales through 1991. For a bargain $7, you learn how to get a fully-functional station on the air for the high-orbit satellites.

A new Webersat manual was offered in loose-leaf form from Weber State University. AMSAT carries this publication for WSU at $15 per copy. For those looking for more data on the inner workings of Weber-OSCAR-18, this edition provides some useful insight.

No new versions of "Instant Track" and "Quiktrak" were introduced this year. The current software packages continue to outperform many amateur and commercial offerings. In addition to the IBM-PC software, AMSAT carries tracking programs for the Commodore, Macintosh, Apple II, Amiga, Tandy CoCo and HP calculator. Software for the older TRS-80 computers and Sinclair machines is no longer supported.

You can get details on prices of the AMSAT software offerings, and publications can be obtained by calling AMSAT at (301) 589-6062 during normal East Coast business hours. Inquiries can also be sent to AMSAT, P.O. Box 27, Washington DC 20044.

RS-14/A-O-21/ Radio-M1/RUDAK-2

This new amateur satellite has brought back the excitement of easy-to-copy strong signals via Mode B (70 cm up with 2 meters down) from low earth orbit. As one longtime hamsat enthusiast said while making a contact via the transponder, "It's like OSCAR-7 all over again, only 6 dB better!"

From its 620-mile-high orbit, RS-14, also known as AMSAT-OSCAR-21 or Radio-M1 or RUDAK-2, is providing excellent communications to stations not yet fully configured for operation on AMSAT-OSCAR-13's high elliptical orbit. This joint Soviet/German satellite is a part of a Soviet geological research satellite. It offers several modes of operation, but the most promising is the transponder system. Frequency charts were published in the May 1991 "Hamsats" column.

Simple systems with omni antennas can access the analog transponder with SSB and CW with ease. Mobile and portable operation with the clarity of Mode B is now a realistic possibility. While the specifications of the uplink/downlink system appear similar to OSCAR-7 (launched in 1974 and operational through 1980), the signals sound much stronger. This could be a result of many years of high-orbit Mode B transponders on A-O-10 and A-O-13 and the extra effort needed to equip ground stations to receive the weaker signals from orbits ten times higher than A-O-21's.

Advances in receiver performance over the last 17 years and small high-power transmit radios give today's A-O-21 enthusiasts an edge over the homebrew and exotic equipment users of two decades previous.

During late May and early June, experiments were underway to test the systems of A-O-21. Some oscillation problems were noted in the preamp of linear transponder number 1. Linear transponder number 2 was operating normally, but due to the investigations of the complete system, it was not always active. Some even heard it switch off in the middle of a pass without ground-station commands.

The best way to check on the satellite and its functionality is to monitor the CW telemetry. For linear transponder two, the data can be heard on

Photo A. AMSAT's booth at the Dayton Hamvention (l. to r.): AMSAT Coordinator Mike Crisler N4IFD, AMSAT President Doug Loughmiller KO5I, and AMSAT Corporate Secretary Martha Saragovitz.

Photo B. AMSAT Executive Vice President John Champa K8OCL answers another question about satellites at the Dayton Hamvention.

145.948 MHz. Decoding the number groups is simple. A typical frame of telemetry consists of eight four-digit numbers.

An actual sample of data copied in late May looked like: PPPPRS14/7007/7116/7224/7316/7409/7500/7600/77. To decode the data, refer to Table 1.

The first four-digit number was "7007." The first digit defines the channel status. A prefix of "6" identifies a general status, while a "2" identifies a command status. The "7" is likely a general status. The second digit, a "0," is the channel number. Channel "0" defines the transponder output. The last two digits give the power level output in watts when multiplied by 0.05. For "07," the result is so close to zero watts that it is assumed the transponder is off. A number in the neighborhood of "80" would give a nominal reading of 4 watts.

The second four-digit number gives the status again as "7," with the channel number as "1." The last two digits, "16," show the transponder power amplifier temperature to be 16 degrees Celsius. If the transponder were on, a higher number with resultant temperature would be expected.

For the remaining channels, the effects are easy to compute. A calculator isn't needed. The numbers directly reflect voltages and temperatures as detected on the spacecraft. Information for decoding the data on channel "7" is not currently known.

The most important number to those wishing to make contacts via the satellite is the value of channel "1." Anything above "40" should reflect active transponder operation. Although DX activity is limited due to the height of the orbit, excellent communications to a few thousand miles range will provide some very satisfying contacts from A-O-21/RS-14. ■

Channel	Parameter	Formula	Unit
0	Transponder Power Output	0.05•N	Watts
1	Transponder PA Temperature	N	Deg. C
2	+24 Volt Regulated Supply	N	Volts
3	+16 Volt Regulated Supply	N	Volts
4	+ 9 Volt Regulated Supply	N	Volts
5	+24 Volt Regulated Supply	N	Volts
6	Inside Temperature	N	Deg. C
7	Engineering Value	N	?

Table 1. CW telemetry decoding parameters.

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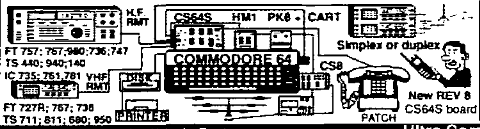
Ultra Comshack 64 Duplex/Simplex Controller

HF & VHF Remote Base*Autopatch*CW Practice*Rotor Control
*Voice Meters*Paging*Logging*Polite ID's*Packet Voice B.B.S.



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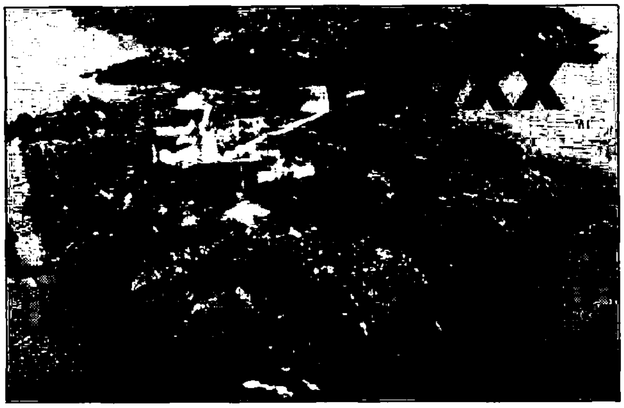

St. Paul Island (CY9DXX QSL card), prefix (CY9).

More DXing Techniques

One of my friends told me recently that he had used what can be considered a bad technique to work a new country. He wasn't necessarily proud of the fact, but after several unsuccessful days of using conventional techniques, he finally broke down and worked the elusive station by "calling out of turn," or "breaking-in." He did this only after he heard another station successfully work the DX station using this technique. This should remind us that there is more than one way to work DX in pile-ups.

Calling on or near the same frequency at the same time as a station working the DX station is considered by many to be rude or unethical. But it is done, and it is too often successful. A more appropriate technique is "tailending."

Tailending means transmitting your callsign on or near the same frequency as the station working the DX station immediately after that station finishes. Tailending is especially successful on CW, and it can be effective in SSB pile-ups as well. But it is not an easy technique to master.

Tailending used against an inexperienced DX operator often causes more problems than successes. A poorly executed tailend does nothing more than QRM the calling station, and more than likely will require the DX station to ask for a repeat, thus slowing his QSO rate. An excellent discussion of tailending is provided by Wayne Mills N7NG in the newly published *Where Do We Go Next?* by Martti Laine and others (KTE Publications, 2301 Canehill Avenue, Long Beach CA 90815). Wayne, an experienced DXpedition operator, shares his experience in Appendix I.

CY9 St. Paul Island

Jan VE2OL reports that a group of amateurs from the West Island Amateur Radio Club (VE2CWI) in Montreal will activate St. Paul Island August 1–7 with the callsign CY9CWI. The list of operators includes VE2SEI, VE2WHO, VE2JBF, VE2DAV, VE2PTT, VE2GZV and VE2OL. Three stations will be active during this operation. The following frequencies have been mentioned: CW—1820, 3520, 3680, 7040, 14050, 21110 and 28050 kHz; SSB—1870, 3795, 7060, 14195, 21295 and 28495 kHz. CY9CWI will also be active on the WARC bands. QSL via VE2CWI.

St. Paul Island sits in the Gulf of St. Lawrence just off the northeast coast of Cape Breton Island, Nova Scotia. Outside of Nova Scotia, few know about it — encyclopedias don't even mention it, and the usual know-it-all geographical dictionaries merely mention its location. But to many residents of Nova Scotia, and to those people who have been there, St. Paul Island is remembered as the graveyard of the Gulf of St. Lawrence.

As many as a thousand deaths have been attributed to the rocky embraces of the island. One of the first recorded shipwrecks was of the English transport *Royal Sovereign*, which was carrying troops home from the war of 1812. Of the 311 men on board, only a dozen or so survived. In 1825 the Canadian barque *Jessie* ran aground on the island during a snowstorm. The crew was able to get ashore, but they died of starvation.

The island, which actually consists of two islands and several rocks, resembles an exclamation mark (!). It's three miles long and averages 1-1/4 miles in width. It is currently inhabited by two lightkeepers who stay on the island for 28 days. Around 1900 there were as many as 40 people living on the main island. There was a post office, a cannery, a school and a telegraph office. The lighthouses were first built in 1838.

The main island, heavily wooded with stunted spruce, is about two miles long. The island on which the lightkeepers live (and DXers operate!)—the dot of the quotation mark—is about two acres in size and about 40 feet above high water. Lighthouse keeper Mel Tanner describes it as "this desert Island of ours." Tanner also mentioned that the island is "...surrounded by a rough, rugged shoreline so exposed to disturbances that we are constantly overcast in spray during winds of any velocity."

Yuri Blanarovich VE3BMV, writing about the XJ3ZZ/1 DXpedition in the November 1977 issue of *CQ*, had the following to say about St. Paul. "St. Paul lies 18 miles northeast of the northern end of Cape Breton Island. It is small, rocky, and practically desolate. The northern point is a detached pinnacle, which appears from seaward to be joined to the main island, but it is separated by a narrow channel about 100 feet wide from the peninsula. The main part of the island rises in two parallel ranges of hills, the southeast being the higher with a summit of 485 feet....

"There are two lighthouses on St. Paul, one on the detached rock forming its northern extreme, and another on its southern point.... The only access to the small island is through the channel separating both islands, and only by small boat. Wooden platforms and walkways abound over the island. It is very difficult to walk on the island during bad weather, as the rocks are slippery and dangerous, but walkways connect all buildings on the island." Yuri also mentioned that "the expedition was not what you would call a pleasure trip, but hard work...."

St. Paul Island qualified as a separate DXCC country based on "separate administration." St. Paul, like Sable Island, was administered by the Federal Department of Transportation. This was established by an act of Canadian Parliament as part of the Canadian Shipping Act.

There have been several DXpeditions to St. Paul since it was added to the DXCC list of countries. The first signed the special callsign VY0A. Other operations included XJ3ZZ/1, VE1CR/1, CY0SPI, CY9SPI, CY9DXX, W5KNE/VE1 and CY9CF. The callsign CY0SPI was issued to the island to be used by ALL operations, but without any obvious reason the licensing authorities changed it to CY9SPI. The island callsign for Sable Island was changed from CY9SAB to CY0SAB at the same time. (Adapted from an article by W5KNE published in the August 1, 1988 issue of *QRZ DX*.) See the photo.

British Virgin Islands (VP2V)

Arch K8CFU, who will be visiting the islands August 16 through 25 with his wife, will be active as VP2V/K8CFU. Look for him on 20 meter SSB. QSL to Arch's *Callbook* address.

Greenland (OX91)

Laurent F6GOX (ex-TK5BL and FJ5BL) is a member of a scientific expedition scheduled to be in Greenland during July and August. Laurent should be active on the HF bands as OX91REF. The callsign of his 6 meter beacon on 50.100 MHz is OX91BCN. QSL via F6AJA.

DXing How-to Books

There have been several excellent DXing how-to books published in recent years, but the two that I believe are the best for new DXers are *The Complete DX'er*, by Bob Locher, W9KNI and *The DXCC Companion* by Jim Kearman KR1S.

Jim's book brings the beginner into the hobby of DXing at an easy pace and Bob's book, written in an interesting narrative style, sharpens the techniques.

Both books are available from major ham radio book outlets. You might want to check "Uncle Wayne's Bookshelf" in this issue of *73*, too.

New Islands-On-The-Air Directory

The new *IOTA Directory*, all 50 pages of it, is now available. It includes a fully updated list of islands to work for the IOTA Awards program and fully revised IOTA rules. Price: Europe—$10 or 15 IRCs; other countries—$12 or 18 IRCs. Send requests to IOTA Director Roger Balister, G3KMA, La Ouinta, Mimbridge, Chobham, Woking GU24 8AR, England.

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Lasers and Photomultiplier Tubes

It has been a year since the FET switcher AC power inverter appeared in this column—August 1990, in fact. The basic switch driver has been used in quite a few different applications. The photomultiplier tube (PMT) covered this month uses a modified version of this power supply to deliver the high voltage required for proper operation. The PMT is a sensitive detector used in the receiver portion of the system. Now for a little about the power supply and PMT requirements.

PMTs and Gain

The laser receiver described last month used a low voltage pin diode. Further improvements can be made by using a PMT with higher sensitivities. The pin diode circuit is modified by removing the first op amp to prevent too much gain from the PMT. In the end I used a single op amp tied directly to the LM386 audio amplifier. Steve Noll WA6EJO used an LM387 in his system, and experimentation proved him correct. The modifications are due to the fact that PMTs are much more sensitive when compared to photo diodes. In fact, PMTs have gains (current amplification) that run in the millions!

Photomultiplier tubes are electron tubes that receive light (a stream of photons) and convert it to electric current. A photo cathode, the first element of the tube, intercepts the light, then emits electrons (or, if you prefer, repels electrons because it's intercepting positive photons) towards the first dynode.

This first dynode is more positive than the cathode, and attracts the electrons. However, due to electron bounce, when electrons hit the dynode, they collide with other electrons on the dynode and join the original electrons at some exit angle. They are attracted by the next dynode (more positive) before they can return to the first dynode. See Figure 1. You might also use the old pool-table analogy to visualize all this activity. This process continues through nine successive dynode stages, providing very high current gains for a very small input signal.

Electron bounce happens in every electron tube, but a grid type structure near the plate, called the suppressor, is tied to the cathode potential. It repels electrons, sending them back to the plate and reducing secondary emissions. In the PMT, the opposite is required in order to obtain current gain.

PMTs can be so sensitive that when they are used for very low light applications, such as astronomy, they are contained in magnetic shields, and cooled to very low temperatures. The magnetic shielding limits external forces affecting the electrons as they are reflected internal to the tube's elements (dynodes), and maximizes performance.

As you can see in Figure 2, the internal construction of the dynode is different in the various types of PMTs. Some types are: the Side-On, the Head-On (compact, with fast response; like the 931), the Box-and-Grid (generally provides best uniformity and sensitivity), and the Venetian Blind (high output, slow response time). All of these PMTs work very well, as time response is not a critical factor for our applications.

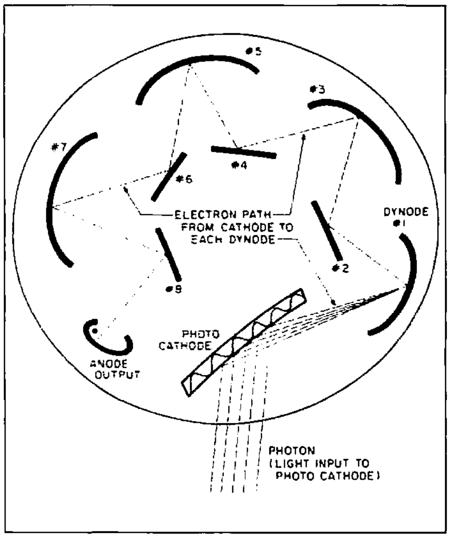

Figure 1. The 931 photomultiplier (PMT), showing current path from photo cathode (light input) to each dynode involved in current amplification. Current gain is very high.

The 931 and similar types of PMTs require a power supply voltage near 1000 volts, and 2 to 3 mA of current for the tube and resistor network. The power supply connections for a 931 PMT are shown in Figure 3. This resistance network is usually contained in a well-insulated tube socket base.

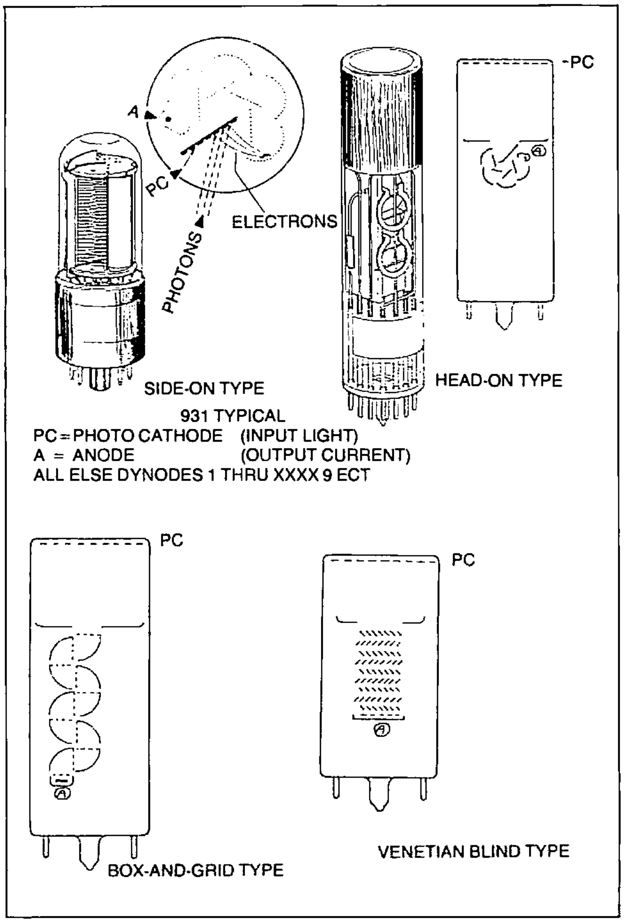

Figure 2. Various types of photomultipliers.

The change to the circuit is minimal. With a PMT, all you need is a high voltage capacitor coupling the PMT's output to the detector's audio preamplifier circuit. A high voltage capacitor is necessary since PMTs operate at a potential around 1 kV, and you don't want high voltage leading into the low voltage audio circuit.

The Power Supply

The PMT power supply uses the basic switch driver coupled with a hand-wound toroidal step-up transformer to produce a home constructed 1 kV power supply at a few mA. The power supply application was covered in detail in the August 1990 column. *[Ed. note: See the May 1991* Updates *section for the schematic.]* In that application, a 24 volt center-tapped transformer was used, driving it backwards, which made the primary the 110 volt AC output. Depending on the current rating of the 24 volt winding, you could obtain 100 or so watts of power at 110 volts AC from this simple system. In our application, the 24 volt transformer is replaced with a home-wound toroid step-up transformer.

The construction of a power supply meeting the PMT's voltage requirements fit well with the FET switcher design. What was desired was a system to operate from 12 volts for portable operation. Construction on a step-up transformer was started by winding a ferrite bobbin (cup core transformer). The cup core type was selected due to the ease of winding a high number of turns required for the secondary. The secondary was wound by hand, and a very small transformer resulted. By using a ferrite cup core transformer, the entire unit can be constructed in a very small container.

The ferrite bobbin/core can be ordered new or obtained in surplus. The transformer construction uses a single ferrite cup core that is about an inch and a half in diameter and an inch high. The cup core transformer is constructed of two identical ferrite halves that sit on top of each other and contain an internal plastic bobbin. This bobbin is removed to facilitate rapid winding. Compared to a toroid, the bobbin can be more easily wound.

The bobbin (transformer) is very similar to a sewing machine bobbin. I was able to wind a primary of 54 turns center-tapped #24 gauge wire with a layer of insulating Mylar and transformer tape (to isolate the primary from secondary) in about three minutes. The secondary required about 1800 turns of #36 gauge wire to obtain the 1 kV needed for the PMT. A small gauge

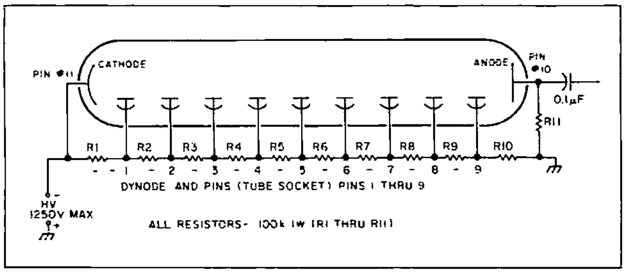

Figure 3. Schematic diagram of a 931 PMT, showing resistor network and high voltage.

wire is used for the secondary, since the PMT's current there is only 1 to 2 mA. The wire gauge is not critical.

In the initial test transformer, I scramble-wound the secondary in one large coil. I have to admit I lost count several times on the exact number of turns, but it was close to 1800. Normally I would have laid a layer of tape every 200 turns or so to give voltage flash-over protection on the secondary, but I didn't do this to the trial transformer.

The enamel wire should be good to 1 kV, but why push it as I did with the prototype? When finished I had plenty of room for the six or so layers of Mylar insulating tape, which would hold voltage to lower limits in each separated winding bundle. Other insulating material can be used.

it, as it can draw quite an arc that I don't wish to be near. Just use good insulation procedures and good construction techniques, and keep you hands out of it when it is on. Can't say it enough: SAFETY FIRST.

Mailbox

Joe Foss USN on the *SS Cleveland* writes that he found an old copy of *73* in Subic Bay R.P. He enjoyed the article covering the 30 MHz IF amplifier used in the receiver for 10 GHz microwave wideband FM. He wanted to build one, but knew that Radio Shack doesn't stock the main ingredient—the TDA-7000 chip. Well, Joe, the chip comes with the kit along with a few other parts that I can muster up to help defray costs. It's amazing how many of these

Once the transformer was completed, I found that due to an error in winding (turns ratio) I had too much output voltage for a current draw at 2 mA. I could have opened up the transformer and removed turns, but I decided it would be better to put a voltage regulator in the switching input circuit, and regulate the DC voltage. This way I could set the output voltage to compensate during test evaluations for different type of tubes. A minor variation, but part of the prototyping game.

All that was required was an LM317 adjustable voltage regulator. I set the voltage to the 9 to 10 volt range for input to the switcher and obtained 1 kV output with ease. A small pot controlled the DC regulated voltage. The LM317 required a heat sink, as it was passing a half amp of current at 12 volts for this circuit, but that's a small price to pay for such easy voltage control. I ran the prototype for three hours, and it did not falter. I did detect some transformer heating, but this was slight, as with the switching FETs. I am always suspicious of something that works the first time.

NOTE: Use caution with this power supply, as it can deliver a lethal jolt! Always keep safety in mind when working with high voltage. Do not think that just because it provides only a small current it is not serious. THINK AGAIN! If you need proof, this baby will provide

simple kits have surfaced on the microwave bands since the first article went out. I still use mine, and it did not have a PC board, being the prototype. Cost of the kit is still $10 postpaid.

Steve Caesar KF8LW is planning several microwave beacons using simple keyed CW oscillators for the bands 450 MHz and up (the 70cm, 35cm, and 23cm ham bands). I supplied a beacon CW IDer for the project.

Junji Tamura JH1MNOY obtained a phase-locked brick from me and reports it arrived safely in Japan. He was very happy to find some SMA connectors and voltage regulators in the package. These are difficult to get in Japan, he says. When Junji completes the negative 20 volt power supply, the brick oscillator will be tested in the lab at the Japan Amateur Radio League. I set the brick up for 10.0040 GHz to use with a 430 MHz SSB radio for operation on 10.475 GHz, their portion of the band.

I am gathering components for a weather satellite receiver operating on 1691 MHz, and I'll report on that when time permits. As always I will be glad to answer questions concerning microwave or related topics. Please include postage (SASE) for a prompt reply. Those without return postage will go unanswered, but may be answered in the column. Best 73s, Chuck WB6IGP. 73

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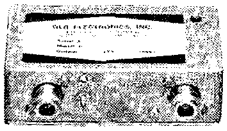

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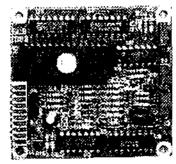

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CIRCLE 17 ON READER SERVICE CARD

UPDATES

Number 19 on your Feedback card

Micro ATV Transmitter

See the above article in the July '91 issue, page 9. Although the Micro ATV Transmitter will work as shown in the article, there are a couple of changes that will improve its performance. There is one error in the original schematic. As shown in the original article, the video clamping circuit will not function. This could cause sync loss (an unstable picture) during wide variations of scene illumination. To correct this, note the new location of the 1k resistor R9 (see Figure 1). Remove the chip resistor R9 from the bottom side of the circuit board and add a standard 1k, ⅛W resistor to the top side. This new resistor R9 should go from the junction of diode D1 and potentiometer R8 to ground (see the new parts placement diagram—Figure 2).

Note that the polarity of capacitor C7 was reversed in the original parts placement diagram. The correct configuration is shown here in Figure 2. Also when using the corrected circuit, you should increase the value of capacitor C7 to 100 µF with a 10 volt rating. Mouser part# 140-MLR10V100 is recommended for C7. One final note: when installing the MRF-911 transistor, make sure that the collector lead points towards the RF out connection.

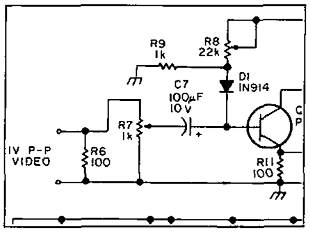

Figure 1. Corrected schematic for the Micro ATV Transmitter. Note new placement of R9.

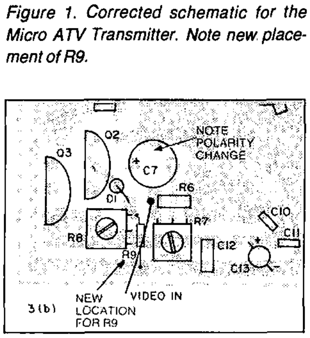

Figure 2. Correct parts placement for the Micro ATV Transmitter. Remove chip resistor R9 from the bottom of the board, then solder a 1k, ⅛W resistor to the top of the PC board as shown. Note also the correct polarity of capacitor C7.

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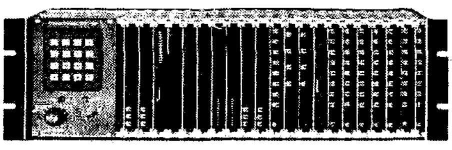

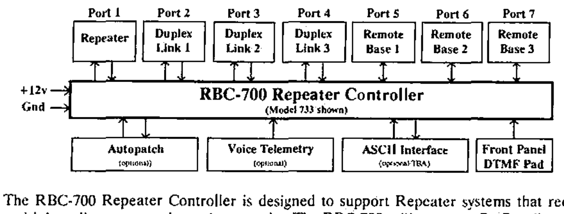

The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

Several models are available and are software configurable to support up to 3 Repeaters, 5 Duplexed Links, and 4 Remote Bases. A group or club can start with the basics and expand their controller anytime by simply adding boards and software. Free software upgrades for one year after delivery. Finally, a real controller for the Linked system operator !

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

AUG 2

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Building beginning at 7 PM. Test fee for Technician through Extra is $5.25. Talk-in on 147.300. Please bring two forms of ID and a copy of your license. Contact ***John Patchett KB2ERJ, (315) 487-0298.***

AUG 3

HANCOCK, MI The Copper Country Radio Amateur Assn., Inc. will host the 1991 Upper Peninsula Hamfest at the Houghton County Arena. A banquet will be held Sat. eve. at the Ramada Inn in Houghton, following the Hamfest. For info on tables call ***(906) 337-5537***, or write to ***Howard D. Junkin N8FHF, Publicity Coordinator, Copper Country RAA, PO Box 217, Dollar Bay MI 49922.***

AUG 3-4

JACKSONVILLE, FL Eight Amateur Radio clubs of the Greater Jacksonville area will combine efforts to present the 18th annual Greater Jacksonville Amateur Radio/Computer Show at the downtown Prime Osborn Convention Center. Swap tables. FCC Exams and Auction will be held on Sun. Admission $5. Reserved swap tables are $15 for the weekend. Fri. set-up is 2-7 PM; Sat. set-up is 7-9 AM. Open for the general public from 9 AM-5 PM Sat., and 9 AM-3 PM Sun. To order advance tickets, send an SASE with payment to ***Greater Jacksonville Amateur Radio & Computer Show, PO Box 10623, Jacksonville FL 32207.*** Swap tables may be ordered via ***PO Box 11882, Jacksonville FL 32239.*** For exhibitor info write ***PO Box 9673, Jacksonville FL 32208.***

AUG 4

CROOKED LAKE, IN The Second annual Land of Lakes Angola Hamfest will be held at Steuben County 4-H Park from 6 AM-2 PM. Camping available. Free parking. Walk-in VE Exams. Advance tickets $3, $4 at the door. Table charge $5; trunk sales $2. Contact ***Land of Lakes Angola Hamfest, PO Box 465, Fremont IN 46737.***

PEOTONE, IL The Hamfesters Radio Club, Inc. will sponsor their 57th Hamfest/Computer Festival at the Will County Fairgrounds from 6 AM-3 PM. Overnight parking. Set-up Sat. $10 plug-in fee by Fairground. Exhibits open at 8 AM. Advance tickets $4, $5 at the gate, under 12 years free. Talk-in on 146.52 and 146.76-. Contact ***David F. Brasel NF9N, 7528 W. 109th Place, Worth IL 60482. (708) 448-9432.***

AUG 10

LOS ALTOS HILLS, CA The Perham Foundation will sponsor an Electronics Flea Market at Foothill College Parking Lot "C". Sellers $10 per vehicle (2 spaces); buyers free. Call ***(408) 255-9000*** for Exam info. Talk-in on 144.67/145.27 MHz SPECS repeater. Campus parking rules are enforced! Please park legally.

BEND, OR The High Cascade Hamfair, sponsored by Central Oregon Radio Amateurs, will be held indoors at Mt. Bachelor Sunrise Lodge from 9 AM-4 PM. 2 meter foxhunt. VEC Exams, commercial exhibits. Advance tickets $5, $7 at the door. Flea Market space $2, $10 with table. Reservations required. Overnight area for self-contained RVs. No hook-ups or tents. Preregistration deadline is June 30th. Talk-in on 147.060 (+600). Contact ***Jack Ulstead N7DDS, PO Box 506, Sisters OR 97759. (503) 549-9480.***

AUG 10-11

HUNTSVILLE, AL Huntsville Hamfest 1991 will be held at the Von Braun Civic Center. Round-the-clock security provided. Free electricity in each booth. Huntsville Hilton directly across the street. Contact ***Huntsville Hamfest, Inc., 2804 S. Memorial Pkwy., Huntsville AL 35801.***

AMARILLO, TX The Panhandle ARC will sponsor the P.A.R.C. Golden Spread Hamfest. Tickets $6 in advance, $7 at the door. Tables $5. VE Exams both days. Wheelchair accessible. Talk-in on 146.920, 146.940 and 146.670. Contact ***P.A.R.C., PO Box 1524, Amarillo TX 79105***, or call ***Troy Reno, (806) 358-5906.***

AUG 11

ST. CLOUD, MN The St. Cloud ARC Hamfest will be held at the Whitney Senior Center on Northway Dr. Donation $4. Talk-in 34/94 primary; 615/015 secondary. Contact ***SCARC, Box 141, St. Cloud MN 56302.***

WARRINGTON, PA The Mid-Atlantic ARC Hamfest will be held at the Bucks County Drive-In Theater on US 611. Set-up at 7 AM. General admission at 8 AM. Admission $3; $2 for each tailgate space. Talk-in on 147.66/.06 and 146.52. Contact ***Al Maslin W3DZI (215) 446-4936***

PAULDING, OH The Paulding County AR Group and Modern Woodmen of America Ins. Co. will co-sponsor a Hamfest at Paulding County Fair Grounds beginning at 8 AM. To register for License Exams, send an SASE and a check for $5.25 payable to ***Bob High, 12838 Tomlinson Rd., Rockford OH 45882.*** For Flea Market info contact ***Allan Helle, (419) 263-3093***, or ***Jerry Rhodes, RR 2 Box 1582, Paulding OH 45879, (419) 399-4507.***

CEDAR RAPIDS, IA Cedar Valley ARC will sponsor the Cedar Rapids Summerfest at Teamsters' Hall, 5000 J St. SW. VE Exams. Free tailgating. Commercial exhibits. Admission $4 at the door. Tables $12 w/power, $10 without. To reserve tables, send an SASE with check payable to ***CVARC, c/o V. Wilcox KB0ONA, 3122 Sue Land HW, Cedar Rapids IA 52404.*** Talk-in on 146.745 repeater.

AUG 17-18

BREWSTER, NY PEARL, The Putnam Emergency and Amateur Repeater League, will hold "PEARLFEST" at the John F. Kennedy Elementary School on Fogginton Rd. VE Exams. Commercial Exhibits. Fox-hunts. ARRL table. Admission $4. Dealer tables $10 in advance. Tailgaters $7. Talk-in on 145.135 -600. Contact ***Joel Rappaport WA2AWG, Box 216, RR2, No. White Rock Rd., Holmes NY 12531. (914) 855-1672.***

ITHACA, NY The Tompkins County ARC is presenting the Finger Lakes Hamfest and Computerfest on Sat., August 17, 1991, at the New York State Armory, Ithaca, NY. Vendors will be offering both new and used equipment, and there will be a large paved flea market area. VE testing is available by preregistration. Send 610 forms to NK2V, P.O. Box 4704, Ithaca NY 14852. Admission is $3 in advance, $4 at the door. Under 18 free. Indoor tables $6, outdoor spaces, $2. Breakfast and lunch will be served. Indoor spaces should be reserved and paid for by July 15. N.Y. Army National Guard equipment displays. For more information contact ***Ross Boyer, N2ISU, T.C.A.R.C., P.O. Box 4144, Ithaca, NY 14852-4144.***

SHREVEPORT/BOSSIER CITY, LA The Shreveport ARA will sponsor a Hamfest at the Bossier City Civic Center. Astronaut Steve Nagel N5RAW, STS-37, will be guest speaker. Admission $3. Talk-in on 147.03/.63. Contact ***Ric Crouch N5QML, 3201 Knight St., Apt. 2508, Shreveport LA 71105. (318) 865-0313.***

MOBILE, AL The Mobile ARC will sponsor a Hamfest at Abba Shrine Temple from 8 AM-4 PM Sat., and from 8 AM-3 PM Sun. Admission $3, ladies free. Tables $12 (200 available, pre-registered only). VE Exams Sun. at 9 AM. Bring two ID's (1 photo) plus original license and copy, and $5.25. Contact ***N4EM***. Talk-in on 146.82/.22; contact ***Marc, PO Box 9315, Mobile AL 36691*** or ***Jess Ferguson N4HPL, (205) 957-6674, PM.***

AUG 18

TOWSON, MD The Moose ARC will sponsor a Hamfest at the Towson Moose Lodge. Admission $3, tailgating $5, inside tables $10. Doors open at 8 AM. Talk-in on 224.12, 224.16, 145.13, 145.33 repeaters. Contact ***Rick N3HIA, (301) 574-3998 eves.***

QUINCY, IL The Sixth annual Tri-States Swapfest (ARRL approved) will be sponsored by the Western Illinois ARC, and held at 3737 N. 5th St., 1 mile N of US 24 and N 5th, from 8 AM-3 PM. Advance tickets $2.50, $3 at the door. VE Exams. XYL activities. ARRL table. Talk-in on 147.63/.03 and 146.34/.94. Contact ***Jim Funk N9JF, c/o WIARC, PO Box 3132, Quincy IL 62301. (217) 336-4191***, or ***(217) 336-3321.***

ELGIN, IL The annual T.C.R.G. FEST, sponsored by the Tri-County Radio Group Inc., will be held at Elgin VFW Post #1307 from 8 AM-3 PM. Set-up from 7-8 AM. Advance tickets $4, $5 at the door. Registered tables $8, $10 at the door. Tailgate space $5. To register, send an SASE with check or MO to ***T.C.R.G., c/o Ken Whitmire N9KSP, 10210 Rt. 31, Algonquin IL 60102. (708) 658-3411.*** Ask for Ken. M-Sat. 10 AM-7 PM CST. Talk-in on 443.025 (114.8 PL), 147.225 + (107.2 PL)

CAMBRIDGE, MA The MIT Electronics Research Society, the MIT Radio Society and the Harvard Wireless Club will co-sponsor a Flea Market from 9 AM-2 PM at Albany and Main St. Admission is $1.50. Free off-street parking. Sellers $8 per space at the gate, $5 in advance (includes 1 admission). Set-up at 7 AM. Covered tailgate area. Contact ***(617) 253-3776.*** For advance reservations make checks payable to ***MIT Radio Society*** and mail with an SASE before Aug. 5th to ***W1GSL, PO Box 82 MIT Br., Cambridge MA 02139.*** Talk-in on 146.52 and 449.725/444.725-PL 2A-W1XM repeater.

AUG 22-24

BLACKSBURG, VA Personal Computer Interfacing-Practical Instrument Automation, Networking and Control Techniques. A 3-day hands-on workshop. Contact ***Dr. Roy Jones, (703) 231-5242***, or ***(703) 231-6478.***

AUG 23-25

SAGINAW, MI The 1991 ARRL National Convention will be held at the Saginaw Civic Center. Advance 3-day general admission tickets are $7, $9 at the door. For lodging reservations ($32-$69 per night) call ***1-800-444-9979.*** Call ***(517) 792-6270*** for camping info. Make checks payable to ***1991 ARRL Convention Committee.*** Mail to ***Camping Registration, PO Box 1783, Saginaw MI 48605-1783.*** Reserve Flea Market tables ($15 each) by calling ***(517) 893-3475.*** Make checks or money orders payable to ***1991 ARRL Convention Committee.*** Mailing address: ***Convention Pre-Registration, PO Box 1783, Saginaw MI 48605-1783.*** If registration with SASE is received before July 4th, the 3-day tickets will be mailed to the applicant. Tickets requests received July 5th-Aug. 16th will be held for pick up. Advance registration closes on Aug. 16th.

AUG 25

FORT WAYNE, IN The Summit City Hamfest, sponsored by the Fort Wayne RC, will be held at the 4-H Fairgrounds on Carroll Rd., from 8 AM-3 PM. Free parking. Tailgating $7. Flea Market. Set-up at 6 AM. Advance tickets $3, $5 at the door, kids under 12 free. Reserved table & chair in open air building is $10; in air conditioned building, $15. Contact ***Frank Jaworski, PO Box 15127, Fort Wayne IN 46815. (219) 485-2634.*** Talk-in on 146.16/.76, 449.875/444.875. All Flea Market reservations include one admission ticket to a maximum of three tickets.

ST. CHARLES, MO The St. Charles ARC will sponsor HAMFEST91 at Blanchette Park from 6:30 AM-3 PM. Forums and License Exams (10 AM). Free admission and parking. Handicapped parking available. Fee for Flea Market space. Talk-in on 146.67 and 444.65 repeaters and 146.52 simplex. Contact ***John Lehnhoff N8HMZ, 155 Brentwood, St. Charles MO 63303. Phone (314) 928-2510 after 5 PM.***

LEBANON, TN The Short Mountain Repeater Club will sponsor an outdoor Hamfest from 7 AM-3 PM at Cedars of Lebanon State Park, US Highway 231, seven miles south of I-40. Exhibitors bring your own tables. Space available on first come, first served basis. Free admission. Talk-in on 146.91. Contact ***Mary Alice Fanning KA4GSB, 4936 Danby Dr., Nashville TN 37211. (615) 832-3215.***

MARYSVILLE, OH The Union County ARC will sponsor the Marysville Hamfest/Computer Show at the fairgrounds in Marysville starting at 6 AM. Free overnight camping with free entertainment on Sat. eve. at 8 PM. Set-up on Sat. at noon. Admission $3. FCC Exams at all levels (walk-in only). The world famous HAMCAM VAN will be on display in the Merchants Building. No advance tickets. Vendor spaces are $5 for a 10' space. Contact ***Gene Kirby W8BJN, 13613 US 36, Marysville OH 43040*** or call ***(614) 261-8871 days; (513) 644-0468 eves.***

AUG 31-SEP 1

ALAMORORDO, NM The Alamogordo ARC will present their Seventh annual Hamfest on Labor Day weekend at the Otero County Fairgrounds from 8 AM-5 PM Sat.; 8 AM-2 PM Sun. RV parking for self-contained vehicles. Admission and parking are free. Tables and booths available on a first-come basis. Talk-in is on 146.80. VEC Exams will be held at 12 noon on Sat: 9 AM on Sun. Contact ***Larry Moore WA5UNO, 1830 Corte del Ranchero, Alamogordo NM 88310-4717. (505) 437-0145.***

SPECIAL EVENT STATIONS

AUG 1-4

GRAND HAVEN, MI In conjunction with the annual Coast Guard Festival, the North Ottawa ARC will operate SE Station KE8DL from 1600Z-0000Z. Frequencies: 7.225/.250, 14.250/.300, 28.400/450. For certificate, send QSL card or equivalent with an SASE to ***KE8DL, 1815 Hillcrest, Grand Haven MI 49417.***

AUG 2-4

ST. LOUIS, MO "Youth in Ham Radio" is the theme of special event stations operating from three locations from 0001Z Aug. 3rd (Friday eve., Aug. 2nd, local time) until 2359Z Aug. 4th. Sammy Garrett AA0CR (1991 Westlink Report Young Ham of the Year) will operate from St. Louis MO; Mary Alestra KB2IGG (1990 Westlink Report Young Ham of the Year) will operate from New York City; Darrel Craig KK6BB, will operate from Fullerton CA. For QSL from any station, send QSL and contact number with a legal size SASE to ***AA8CR, PO Box 5832, St. Louis MO 63134.*** For a certificate for contacting all three stations, send 3 QSLs and 3 contact numbers with a 9x12 SASE. Frequencies: General/Novice portions of 40, 20, 17, 15 and 10 M (phone/CW)

AUG 10-11

BARNEGAT LIGHT, NJ The Old Barney ARC will operate SE Station W2OB from 1200-2300UTC Sat. and Sun. to celebrate National Lighthouse Day. Frequencies: CW-7040, 14040, 21040, 28040; SSB-7275, 14290, 21390, 28390; 146.835 repeater; 146.52 simplex. QSL via ***Joe Fleishinger NU2F, 75 Joshua Dr., Manahawkin NJ 08050.***

AUG 14-16

BRIDGEWATER, NJ The Somerset County Office of Emergency Management will operate WC2ADK 1400-0100Z each day to promote Amateur Radio, R.A.C.E.S. and Public Service at the annual 4-H Fair. HF on lower 25 kHz of General 80-10 meters, packet, ATV; visitors on 145.32 simplex. Send QSL and SASE to ***Somerset County OEM/4H, PO Box 3000, Somerville NJ 08876.***

AUG 15-16

YORKTOWN, VA The Southern Peninsula AR Klub will operate N4KZR between 1400Z and 2200Z on Aug 16, 17 and 18, to commemorate the 300th anniversary of the Founding of Yorktown VA, where the last battle of the American Revolution was fought. Phone operation is planned for the General portions of 80, 40, 20 and 15 meters, as well as the Novice 10 meter phone subband. For a commemorative certificate, QSL with SASE to ***M.C. Ellis, 300 Artillery Rd., Yorktown VA 23692.***

AUG 17-18

VANCOUVER, WA The Clark County ARC of Vancouver/Clark County WA, will sponsor station W7AIA to help celebrate the 32nd annual Antique Aircraft Fly-in and Display at Evergreen Flying Field (just East of Vancouver). Operating times will be from 1800-2359 UTC Sat.; 1800-2300 UTC Sun. Frequencies: Lower portion of General class part of the 40, 20, 15 meter bands and on or near 28.455 in the Novice/Tech portion of 10 meters (conditions permitting). For a commemorative certificate showing a 1917 Jenny, SASE only to ***CCARC, W7AIA, PO Box 1424, Vancouver WA 98668.***

MANITOWOC, WI The Mancorad RC of Manitowoc will operate W9DK from 1400-0000Z both days, from the WW II Submarine "Cobia" to celebrate Maritime Week. Frequencies: 7.250, 14.250, 21.350, 28.450. For certificate, send QSL and an SASE to ***Mancorad RC, PO Box 204, Manitowoc WI 54221-0204.***

AUG 28

TRANSITION NIGHT QSO PARTY for 135 CM The Eastern VHF/UHF Society urges amateurs to join together on the 135 CM band on the eve of Tues. Aug. 27th, to honor our 135 CM past and open our new band and opportunities. This event is to be known as "The 220 QSY QSO Party." Phase A extends from 2200-2400 GMT Aug. 27th (the last few hours before the change). The entire band, 220 to 225 MHz can be used. Phase B, from 0000-0400 GMT on Aug. 28th, is the first 4 hours after the change. Use of the entire band is allowed. For complete instructions and rules, contact ***Eastern VHF/UHF Society, Thomas J. Kirby W1EJ, 1 Meadow Knoll, PO Box 455, Pelham NH 03076.***

AUG 28-SEP 2

MOUNT PLEASANT, IA The Mt. Pleasant ARC will operate W0MME during the 42nd annual Midwest Old Threshers Reunion. Operation will be in the General portion of the 80-10 meter phone bands. Club members will monitor their 444.95 and 147.39 repeaters for those attending. For a QSL send an SASE to ***Dave Schneider WD8ENR, 507 Vine, Mt. Pleasant IA 52641-2846.***

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Packet or RTTY— Which is Better?

Packet, packet, packet . . . who's got the packet? As one of the newer forms of digital communication, packet circuits have certainly taken amateur circles by storm. Look around this magazine if you doubt this fact. Nevertheless, packet just might not be for everyone. To wit, consider this letter from Howard Evans W6IDS.

Howard writes, "I run a landline bulletin board named 'Amateur Radio CBCS' in Rancho Cordova, California. . . . What interests me is the number of users who have mentioned in the message areas (both local and national) that there seems to be a bit of disappointment regarding packet. It seems that the common line focuses on the apparent 'overload' of the packet systems in general.

"In the messages, I read comments about a pronounced delay in the forwarding/receipt of packet mail, and a marked comparison of RTTY to packet in through-put efficiency, with RTTY standing out.

"I have tested packet a couple of times and I must say I still prefer RTTY for general communications. I know the technology is in vogue, and it is chic to be a packeteer, but the amount of cost required to set up a reasonable packet station versus using a normal RTTY station, to me is not really justified. Of course, this is my own opinion, and frequently I am at odds with the vast majority on issues. I just can't get excited about packet, even if it is the in-thing to do today.

"For that reason, I am very disappointed at what appears to be a decline in active RTTY stations. Oh, I know they're there, but it *used* to be easy to find the critters lurking about, either monitoring for a call, or already engaged in a contact. I have spent some time tuning around, and it does seem to me that the general RTTY activity is declining. I think that is our loss.

"It is my contention that for HF communications, RTTY is the better way to go, overall. And yet, more people continue to focus on packet, only to reflect later on how 'slow' it is, and how entangled it has become in territorialism, intra-system bickering, and politics.

"I'm not trying to convince you of a particular point of view, rather I am trying to convey a sense of concern over what I perceive as an insufficient arrangement of priorities which has placed packet over RTTY."

AMTOR Hardware

Strong sentiments, Howard. I wonder how many others agree. Over the decade and a half this column has been running, I have seen many trends come and go. Will packet be just another fad, or does it have a true place in the scheme of things? I certainly look forward to other readers' thoughts and comments on this apparent schism in the digital world.

If packet has its critics, how about other non-Baudot forms of digital communication? Garry Hawkinson WA0RXB of Proctor, Minnesota, asks whether AMTOR is a software operation using a regular terminal unit, or if other hardware is required as well.

I guess the answer is yes . . . and no. One way to get onto AMTOR is with one of the newer multimode terminal units. These little wonders take care of all the work of encoding and decoding the various AMTOR modes, requiring only a dumb terminal on your end. We have mentioned AEA and Kantronics units in this column in the past, but other schemes are possible, including those that move all the smarts for the protocol into your computer, and rely only on the switching circuits of a terminal unit to complete the connection.

However, whatever technique you choose to get onto AMTOR, your transmitter and receiver have to be able to switch from transmit to receive and back again very quickly and cleanly. When using a mode which requests block-by-block confirmation, such as AMTOR or packet, efficient transmit/receive switching is a must.

One such problem was addressed in the July 1990 "RTTY Loop," in which a modification for the ICOM IC-740 transceiver was published. The transmit/receive timing was altered, allowing for more efficient and accurate AMTOR transmissions.

Hope this helps you sort out the alphabet soup of RTTY modes. We have covered AMTOR in depth in the past, and will continue to look into it in the future.

AMTOR and RTTY Bands

Once you get on AMTOR, though, the question of where to find QSOs comes up. This puzzles William Martin N7EU, who writes that he has ". . . been operating RTTY and AMTOR for about five years now, and wonders about the operating habits on this mode. Why is it most of the fellows seem to congregate on either 80 or 20 meters when there is so much other spectrum to try? It would seem to me that 40, and especially 30, meters would be an ideal band to use during the daytime period of operation. Since I don't have an 80 meter antenna yet, that leaves me only 20 meters to slug it out trying to make a contact on these two modes. On 20 it seems the boys really get crammed into a small portion of the band, making it difficult to make a contact. Thirty meters seems to be quiet most of the time, with a notable lack of activity on RTTY and AMTOR. Is it some unknown tradition that keeps the hams on RTTY in a certain band, or are they not interested in trying something new? Even on 10 meters, where you would expect some Novice to try RTTY, activity is nil.

"Maybe in one of your upcoming articles you could respond to my question and encourage some of the fellows to try 40 and 30 meters. After all, 30 is a CW/RTTY exclusive band, and seems well suited for this purpose. Is there a "calling" frequency on 30 that I am unaware of, or is everyone out to lunch on this one?

"I really enjoy the two modes, and find AMTOR to have a bit of an edge over RTTY at my power level (100 watts) and modest dipole antenna. I use the CP-1 with the MBA-TOR inserted into the back of the C-64, and find it quite adequate for my level of operating with these modes. I bought these items used, and they are quite adequate for the beginner.

The only disadvantage I can see is that this setup does not support packet. But I suspect that could be overlooked, considering the bargain price. You could always pick up a separate unit for packet later."

Well, William, I would say that the answer to your question about band use can be stated in one word: INERTIA! Hams congregate around these frequencies because that's where they started; they have always been there. Why those frequencies were chosen has to do with conditions no longer applicable, like crystal availability and VFO stability. That they were chosen remains quite applicable, because if you are looking for a QSO, you can tune where you know others are listening. And so the pile-up grows! There is nothing inherently wrong with staking out a new frequency, as long as it is in a valid RTTY band and you are not stomping on some net.

This is a good question, with valid arguments on both sides, and I look forward to hearing some other readers' comments on the topic.

As far as the hardware you are using, it is good to see that a shoestring system (by cost) does not have to be too limited. Great tips on the C-64 and accessories.

Check out those garage sales and flea markets, folks. After all, one man's trash may be another's terminal.

Drop me a note when you are on your terminal, or at your quill and pad. Either by mail, as these folks did, or on one of the online services: CompuServe (ppn 75036,2501) or Delphi (user name MARCWA3AJR). 73

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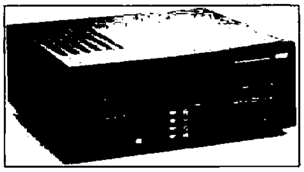


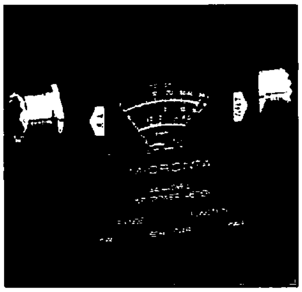
DRAKE

R. L. Drake's new R8 worldband shortwave receiver lets you hear world events as they happen. The R8 can be programmed to store up to 100 stations in memory for instant recall. A full complement of state-of-the-art filters and computer interface capability are also built in. It operates in the AM, LSB, USB, CW, RTTY and narrowband FM modes. The frequency range is 100 kHz–30 MHz, and covers all wortdband frequencies as well as most amateur bands. With an optional module, the R8 can also cover fire, police, public service broadcasts, and additional amateur bands in VHF (35–55 MHz, 108–174 MHz).

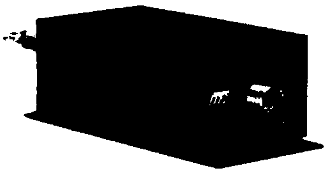
The suggested retail price for the R8 is $979. For more information, contact *R. L. Drake Company, P.O. Box 112, Miamisburg OH 45342; (513) 866-2421.* Or circle Reader Service No. 201.

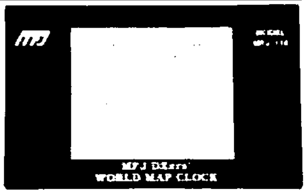
RADIO SHACK

Radio Shack is now offering the Micronta® Ham Radio SWR/Power Meter (cat. no. 19-320). This compact meter is ideal for optimizing antenna settings for hand-held transceivers as well as mobile or fixed ham radios. It is specifically designed for use on two popular amateur radio bands: 2m (144 MHz) and 70cm (440 MHz). The SWR/Power Meter's main features include: low insertion loss, enabling it to remain connected at all times; wide-range accuracy that lets the user measure power up to 60 watts; and a sealed diecast aluminum enclosure for durability.



The meter retails for $39.95 and is available at Radio Shack stores and participating dealers nationwide. For more information, contact *Radio Shack, 700 One Tandy Center, Fort Worth TX 76102; (817) 390-3300.* Or circle Reader Service No. 202.





MFJ

MFJ has released two new products: a balun box and a world map clock. Mount the **MFJ-912 W9INN Balun Box** outside the building and connect it with coax from your wide-range T-network tuner. The MFJ-912 will convert the unbalanced coax to the balanced ladder-line transmission line, functioning like an internal balun even though it's located away from the tuner. It retains the flexibility and efficiency of the ladder line without bringing the line into the shack.

The **MFJ-110 DXers' World Map Clock** shows the time and date at any QTH in the world, and also lets you see the location of your contact. Easy-to-use pushbuttons let you instantly move the display to a QTH in every time zone. The "recall" feature instantly moves the display back to local time. The clock shows the day of the week, month, date and year, and has an alarm.

The MFJ-912 W9INN Balun Box is $39.95; the MFJ-110 World Map Clock is $24.95. Both come with a one-year unconditional guarantee. Contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762; (601) 323-5869, (800) 647-1800, FAX (601) 323-6551, Telex 53 4590 MFJSTKV.* Or circle Reader Service No. 203.

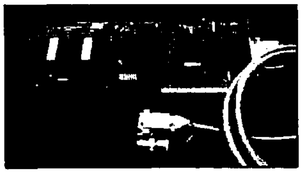
ICOM

ICOM has announced the new IC-2410A/H 144 and 440 MHz dual-band transceiver, which includes features such as simultaneous receive on the same band, microphone controllability and optional remote control. The IC-2410A/H is one of the smallest in its class: 5.5" (W) x 1.6" (H) x 6.9" (D), and weighing just three pounds. In addition to receiving two bands simultaneously, it will receive two frequencies on the same band.

The IC-2410A/H comes in two versions. The IC-2410A puts out a maximum of 25 watts on both UHF and VHF; maximum output power for the IC-2410H is 45 watts on VHF and 35 watts on UHF. Both versions offer high, medium and low power settings. A variety of operations can be controlled with the HM-56 DTMF hand microphone and optional UT-55 DTMF encoder/decoder.

For prices and more information, contact *ICOM America, 2380 116th Ave. N.E., P.O. Box C-90029, Bellevue WA 98009-9029; (206) 454-8155.* Or circle Reader Service number 209.

GRACILIS, INC.



Gracilis, Inc. has introduced the PackeTwin™ data system, a dual-channel PC interface card, integrated radio modem, and radio transceiver, with TCP/IP and AX.25 software for PC/XT/AT systems. Both PackeTwin channels can operate at conventional speeds of 1200–9600 baud. Additionally, one channel is capable of 1 Mb/sec operation with existing 56K radio modems as well as future higher speed developments. Both channels support RS-232, RS-422, and TTL. Radio modems are available for 1200, 2400 and 9600 bps. KA9Q's TCP/IP system software is also available with the system for packet network applications.

PackeTwin prices range from $199 to $599, depending on the configuration. For more information, contact *Gracilis, Inc., 623 Palace Street, Aurora IL 60506; (708) 897-9346* Or circle Reader Service No. 205.

RAI ENTERPRISES

RAI Enterprises has released a new PC software program, "Autolog Plus II." This program is a unique blend of a highly sophisticated station log and a fully programmable CW autokeyer. The log features four programmable on-screen time zone clocks, a 200-year calendar, a personal database and a notepad database to keep track of all personal data. Other features include a DXCC database, beam headings, QSL tracking, custom screen colors, on-screen "quick notes"to keep track of frequencies and calls in a pile-up, a programmable tracking cell with sort and print functions, and the ability to search and modify all log files. The only hardware requirements are a printer driver and 360K of free memory. An RS-232 interface is provided to drive the positive voltage CW key input of a solid-state receiver.

"Autolog Plus II," including the interface, sells for $45 and is available on both 5.25" and 3.5" floppies. For more information, contact *RAI Enterprises, 4508 N. 48th Drive, Phoenix AZ 85031.* Or circle Reader Service No. 204.

ALEXANDER BATTERIES

Alexander Batteries is offering several new made-in-the-USA batteries for Standard HX500 portable radios. The H26204 is a 7.5V/500 mAh nickel-cadmium battery. The H26205 is also rated at 7.5 VDC, but features longer run times and a 900 mAh capacity. The H26206 is 10 VDC, with a 425 mAh capacity; the H26207 is 10 VDC/700 mAh. Alexander's also has replacement batteries for the ICOM BP-83 and BP-84, and for Kenwood's TH-205A, TH-205AT, TH-215A, TH-215E, TH-315A, TH-415A and TH-415E radios.

For prices and more Information, contact *Alexander Batteries, P.O. Box 1508, Mason City IA 50401; (515) 423-8955, FAX (515) 423-1644.* Or circle Reader Service No. 207.

HI-RES COMMUNICATIONS

Hi-Res Communications has released the KWM2 video, packed full of detailed information regarding almost every facet of the KWM2 and spotlighting world-renowned Collins Radio expert Dennis Brothers. The video begins with basic tools and equipment, then Dennis takes you through tune-up and operation, troubleshooting and repair, modification identification and installation, and complete alignment.

For the price and more information, contact *Hi-Res Communications, Inc., Floyd Soo KF8AT, 18464 Ash Creek Drive, Mt. Clemens MI 48044-1240; (313) 228–1600*. Or circle Reader Service No. 206.

OPTOELECTRONICS

Optoelectronics is offering a new, free (to people involved with radio broadcasting and reception from sub-audio to 3 GHz) 16-page brochure describing the firm's newest hand-held and bench-top instruments. The brochure includes descriptions, technical data and useful tips on how to use frequency-finding handi-counters, universal counter-timers for lab and field, PC-based counters with Windows 3.0 for control and display, active preselector band-pass filters, antennas and accessories.

Contact *Optoelectronics Inc., 5821 NE 14th Avenue, Fort Lauderdale FL 33334; (800) 327-5912, (305) 771–2050.*

GIEHL ELECTRONICS

Giehl Electronics is offering two software enhancement kits, one for the Kenwood TS-940 and one for the Ten-Tec Paragon. The TS-940 kit features tunable memories that allow you to change the frequency of a memory channel using the main tuning knob, memory bank selection using the "UP" and "DOWN" keys, and easily-set kHz per revolution. The Paragon kit offers band registers that store the last-used frequency, mode, and filter for all bands 160 through 10 meters; a 10-minute timer that reminds you to ID your station, a single key band selector that makes QSYing fast, and many other enhancements. Both kits include a new software chip, complete documentation, and installation instructions.

The kits cost $72 each, plus $3 S & H. For more information, contact *Giehl Electronics, P.O. Box 18335, Cincinnati OH 45218*. Or circle Reader Service number 208.

QSO Comp-Troller
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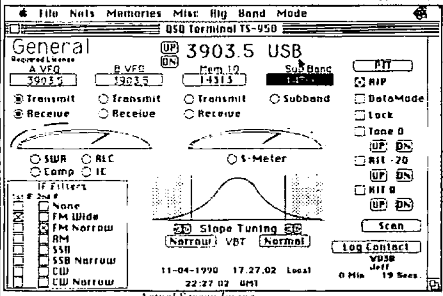
New!

QSO Software proudly announces a second entry in quality ham radio software. QSO Comp-Troller offers complete PC control of Kenwood transceivers. The program is available for the Macintosh and MS-DOS (IBM Compatible) PCs with 64K EGA or VGA Graphics and a Microsoft® compatible mouse. QSO Comp-Troller is currently optimized for the Kenwood TS-950 transceiver, and will control all other RS-232 compatible Kenwood radios. Major functions included in the software are listed below. (Not all Kenwood models support every function)



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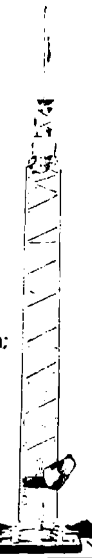

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CIRCLE 53 ON READER SERVICE CARD

Never Say Die

Continued from page 4

band and every mode, even a USA report which mentions *Radio Fun*. There's 20 pages of DX news!

About the only thing they don't seem to have is something along the lines of my endless editorials. Probably just as well.

It's a magazine packed with interesting information, aimed at rank beginners right on through to experts, with the latest news and circuits for every special interest.

For us to have a similar publication here we'd have to have about 300 pages of advertising. In order for the ham industry to support that much advertising they'd have to sell about five times as much ham gear as they do now. And that would mean that we'd have to have about four times as many active hams buying.

Yes, Japan is *that* far ahead of us. They're leaving us further and further behind in radio technology. It's a terrible blow to American pride to be left in the dust, fiddling around with CW and AM instead of exploring the microwaves.

Many Americans have suffered severe inferiority attacks as we've had to learn about quality, just-in-time production and other Japanese innovations. Now it's no-code and the Luddites are at it again.

Mini-Discs?

Sony, apparently unable to keep from challenging Matsushita (and losing), has announced a new recording technology, the mini-disc (MD). This was in response to Philips and Matsushita's Digital Compact Cassette (DCC) announcement in January.

So what's all this mean to amateur radio? Isn't this just of interest to music lovers? What do we care if the Japanese come up with something to replace the old audio cassette? It's about time anyway, right?

Since analog audio will soon be as dead as spark, our analog voice transmissions are going to be as antique as our beloved CW. Amateur radio is already so far behind today's technology that it's more a museum exhibit of the past than a practical communications service.

The only main drawback to digital audio is that it takes a much wider bandwidth than analog. Let me see some hands now. . . how many of you are prepared to get up in front of the group and explain the difference between analog and digital? Hmmm, not many hands. I was afraid of that.

What we do is pick up analog audio with a microphone. Then we set up an oscillator and have it trigger on a sampling circuit. The audio on our compact discs (CDs) is sampled 44,100 times a second. A 16-bit byte allows you to break down the sound into 65,000 sound levels and represent each by a number. This makes it possible to digitize frequencies from 0–20,000 Hz. . . up to half the sampling rate.

For ham use we might want to cut down to a 6 kHz sampling rate, which would give us 0–3,000 Hz, plenty for ham communications, yet too wide for most of our ham bands. This is where we want to start looking for ways to compact the data. We don't need anywhere near the 80 dB of dynamic range demanded by music, so we don't need music's 16-bit bytes. We can further cut down the data rate by using one-bit technology. This, instead of giving us the signal level from zero to 120 dB for every sample, just tells us whether the data number is lower or higher.

Okay, okay, it's complicated and, unless you've been keeping up with electronic technology, it's confusing. I just wanted to give you some idea of what's going on, not make you a digital scientist. Not that all this is beyond the grasp of an eleven year old. . . it just may be beyond the grasp of the average 59-year old ham who is bewildered about what a decibel actually is.

How long do you think Congress and the FCC are going to consider amateur radio a resource worthy of using our incredibly valuable bands if we keep falling further and further behind in technology? When will they stop and consider that maybe they don't need to provide quite so much museum space for us to insult and jam each other with our antique frequency-wasting technologies?

Up until about 25 years ago, amateurs were the leaders in communications technology. We pioneered NBFM, SSB, SSTV, RTTY and repeaters. Then everything almost completely stopped, leaving us with a hobby frozen in time at around 1963. Was it entirely a coincidence that the ARRL's Incentive Licensing proposal almost completely stopped the entry of young newcomers at this same time?

The increasing complexity of home construction using ICs didn't help. Oldtimers, brought up on tubes, got scared off by these little gadgets and the enormously complex circuits they could build with them. I still fondly remember building rigs with 815s, 826s, 832s and 813s. Sigh.

We *will* be going digital. It's just a question of if we have to wait for the Japanese to pioneer it for us. And as we are able to get our effective bandwidths down to a few hertz, we're going to find ourselves with wide open bands, with acres of space between contacts. . . more like 40m CW used to be 60 years ago. When Sony is able to knock out 80% of the data for hi-fi music and we're not able to hear the difference, the possibilities for ham communications quality voice are staggering.

If there's any real interest, we can start encouraging the writing of technical articles to help you cope with 1990's technology instead of living in the glorious 1940's technology as most of you have. Do you want to know more about digital audio?

Where Was Wayne?

A couple readers noticed my absence at the Dallas hamfest this year. I was over in Sedalia (MO) at the 11th International Scott Joplin Ragtime Festival—same weekend.

Since I've been pretty good at keeping my love of ragtime music a secret, it may surprise you that I would fly to Kansas City and then drive to Sedalia, just to hear ragtime music. Four glorious days (and nights) of ragtime, played by the world's top ragtime performers. . . nirvana.

It didn't hurt that two of my proteges were on the program this year for the first time. Scott Kirby, who I discovered in New Orleans, and Masanobu Ikemia, who I discovered at Sedalia last year, when he was just there as an attendee and not on the program. This year they were the big hits of the festival. . . with me sitting there glowing like a proud papa.

The festival drew about 350 attendees. I'll bet over a hundred of them played at one time or another in the after-hours ragtime jam sessions. . . which went on after the last evening concerts until as late as 6 a.m.

Last year I missed the last two days of the festival and flew up Saturday morning to give a talk at the Dallas hamfest. Only a couple dozen hams managed to break away from the flea market to listen, so I figured I'd do better to spend my time in Sedalia this year.

With two ragtime CDs already released on my Greener Pastures label and two more in the works. . . plus several more planned. . . the festival was a business investment too.

The lack of interest in my Dallas talk last year means either that most hams have had enough of me in my editorials—maybe too much—or that my talks have grown dull. Probably the latter. When I'm giving talks to hams I often feel like a cheerleader trying to get some enthusiasm from the inmates of a nursing home. When I ask for a showing of hands on how many in the audience have done *anything* of interest in amateur radio, a couple hands go up. The others all slouch down and look guilty.

I don't know what to say. It's like a bunch of starving people not quite able to touch the fabulous feast just beyond their reach. Have you tried OSCAR? RTTY? SSTV? These 20-year old technologies are still newfangled stuff to many hams. Even packet is new! Lordy. Whatcha done on 220? 900? 1296? 10 GHz? Maybe 50 MHz? They didn't need me as a cheerleader at Dallas this year, just as a funeral director.

One of the top American ragtime pianists is Dick Zimmerman. He's also a professional magician. Perhaps I should take some magic lessons from him and at least be able to entertain you old-timers with some magic, even if you don't want to hear about amateur radio.

Beating the Pile-Ups

If you're one of the thousands of ops devoting the rest of your life on this world to adding QRM to pile-ups chasing DX, I have a suggestion for you. Are you interested in a sneaky way to come out on top of the pile-ups, time after time?

Yes, I know, you already have a twelve-element beam and a ten kW linear. . . but so do all your competitors. You need something extra to make it through the QRM. It's odd that you haven't thought of this already, but then perhaps you haven't gone about solving this problem creatively. Your use of 10,000 watts is a hint that you tend to try and use brute force instead of brains to get your way. I hate to think about your family relations!

Okay, here's the edge which should make all the difference. Perhaps you've noticed that when you are transmitting, this tends to reduce your ability to hear what's happening on your channel. You know there are others in there, but you don't know exactly when they are transmitting or how much they've shifted off the frequency to try and be heard. You need a way to listen while you are talking.

Think how great it would be to be able to tune in and hear what's going on while you're calling! You'd be able to shift your frequency enough to be heard. You'd be able to wait until just the right moment and both jam your competitors so the rare DX station wouldn't be able to get their call. . . and sandwich your own call in the instant they shut up.

Now that I've told you what you need to do, I'm sure you're way ahead of me on how to do it. You need a remote receiver with a UHF link back. If it's a few miles away you'll be able to hear your own frequency and everything on it. We have enough garbage on 2m already, so put your intercom channel up on a higher band. You'll want to be able to remotely tune too. But that's easy with many modern receivers. Duck soup.

How about some construction articles on remote receiving systems?

Some Trivia

You might watch for "Mission of the Shark," a TV movie which is planned for broadcast around December 7th. I don't know how good the movie is, but it was shot on my old submarine, the *USS Drum* (SS-228), where I spent the war. The *Drum* is tied up in Battleship Park in Mobile, right next to the *Alabama*, in case you're down that way.

The movie stars Stacy Keach as Captain McVay, skipper of the *Indianapolis*, and Richard Thomas (John-Boy) as the ship's doctor. The *Indianapolis* was sunk by a Japanese submarine (played by the *Drum*), with Japanese-American actors. The cruiser was returning from having delivered an atomic bomb when it was sunk. Most of the crew survived the sinking, but were subsequently lost to sharks during their several days in the water because a Navy bureaucratic blunder prevented anyone looking for them.

American Cars

A couple Detroit union member readers got all upset over my put-down of American cars a few months ago. They told me how great American cars are now. Glad to hear that, even though it goes against everything I've experienced with rentals.

Thus it was with some interest that I read a report in *USA Today* on how U.S. car brands had improved their quality. Ford did the best, moving from the 18th to 8th best trouble-free brand. Out of the top eleven most trouble-free 1991 models, Pontiac placed 7th with their 6000. The other 10 were all foreign. In the trouble-free brand list the first seven were Lexus, Infiniti, Toyota, Mercedes, Acura, Honda, Subaru. . . and then Ford. You can't believe how distressed I am to be so wrong about American cars being clunkers. . . and my Detroit readers so right. Yes, I'm being sarcastic.

I don't suppose I've gotten you to read *The New Yorker* yet. Pity. Damned shame. They had a very interesting series on Chinatown recently that was worth reading. We seem to get mad at the Asians for coming over here and working incredibly hard to succeed. They aren't doing anything we can't do, they're just doing what we won't do. . . work.

Heck, a lot of hams are furious with me because I've worked so hard and have succeeded as a result. I was lucky to have good role models. My father worked hard, as did my grandfather, so it seemed normal to me. My grandfather was one of the founders of Citgo and my father helped start the first trans-Atlantic airline.

And how does this apply to amateur radio? Why am I bringing this up here? Because it's the same pattern I see in

amateur radio . . . we want to buy a rig, put up a manufactured beam and tower and work the world. Thousands of readers get mad at me when I suggest they actually learn electronic and radio theory. They are ready with a rope when I suggest that if they love the damned code so much they get good at it and prove it. They are starting the fire under the tar when I ask why they aren't on packet yet. Or OSCAR. Shoot the messenger. No, I'm not saying that American amateurs are a lazy, spoiled bunch of old-timers. I would never say that. You might say it, and I wouldn't deny it, but I'm certainly not going to say it.

Now, if our beloved and wealthy, uneducated and apparently unskilled Detroit car makers would make some extra effort to turn out cars without defects I'll be delighted to start checking my gourmet library for crow recipes. Perhaps cooked in Ripple?

Education

Did you miss the *Forbes* articles on education (May 27th)? Tsk. Milton Friedman (one of my heroes) said, "On the average it costs half as much to run anything privately as it does governmentally." Friedman says that our Ivy League colleges could cut their tuitions in half and still make money if they were exposed to the disciplines of the market rather than counting upon government subsidies and big private donors. He says "that universities are multiproduct enterprises. They produce three major products: schooling, research and monuments."

One shining success is the DeVry Institute of Technology, which provides a better education than even state colleges and at half the price. Yes, of course state educational authorities are fighting DeVry at every turn.

You know, if we could ever get Congress to allow private mail, we'd see twice as much service at half the cost. I'm old enough to remember two mail deliveries on weekdays and one on Saturdays . . . 2¢ first class mail and penny postcards.

IBM Dying?

Several years ago I predicted that IBM would eventually get killed by microcomputers. If you've been reading the business magazines you've been seeing IBM losing ground at an amazing rate. It's going to get worse.

Just as we've had a drop in the cost of computing of about a thousand to one in the last few years, the predictions are for a further million-fold rise in cost effectiveness within a few more years. To some degree IBM will be able to sell more of the lower priced computers, but there's no way they can sell a million times more.

IBM makes most of their really big bucks leasing software. The day of the three-thousand-dollar-a-month software lease is going away, right along with the need for $10 million computers.

Ten years ago I had to pay $15,000 for a 10 megabyte disk for my Prime minicomputer. Now they're building 40 megabyte drives into laptop portables.

So what does this mean to amateur radio? It means you ain't seen nothin' yet when it comes to computerized communications. It also means there are going to be an enormous number of opportunities to make big bucks with these new computer systems. Small entrepreneurial companies are going to have a field day with support products, running circles around the giants. Small companies can react much faster than big ones and drive them bananas.

Chip densities are moving towards billions of transistors on a single chip. That means they can put dozens of ultra-fast microcomputers all on one chip, working in tandem. This is going to force a similar expansion in communications. We have the choice of being spellbound, dumb bystanders . . . or plunging in and benefiting from the changes.

This explosion of communications is going to start making frequencies more valuable . . . particularly the microwaves. This means, in turn, that either we're up there earning our salt or we're going to gradually be left like our American Indians, on tiny, unwanted reservations.

Of course, if we had friends in high places, we might be able to stave off the inevitable. And how can we develop some friends in high places? The same way the big corporations who want our frequencies do . . . by bribing Congress. We have a democracy here, and that means you pay or you die. For as little as $100 each per year to your senator and representative (for their re-election funds), you'll help assure that you have a louder voice at that old radio spectrum pork barrel than Motorola, G.E. or Fujitsu.

73's To You, Too

Sevens and threes to ya good buddy, as the southern truck driver CBers put it. No, you don't have to puzzle about where "73" came from, you jist pay 'tention to your old Uncle Wayne, and he'll put ya straight.

It has to do with the very beginnings of amateur radio, away back near hunnert years ago. Some of the first hams were old Morse ops who'd worked on the telegraph lines out West. Out there a man's most precious possession was his gun, the good old Winchester 73, the gun which opened the West. The old ops used to end their messages with "I will you my 73." That got shortened, in true CB style, to "73," and meant "best wishes." You can tell if a ham is a lid if he pluralizes it. It ain't "best regardses," it's "73." Now aren't you glad you have old Uncle Wayne as a living link with the past . . . good buddy?

The next thing you'll be asking me where "88" came from. Git off the porch and let a cranky old man alone. Jeeze, these danged kids. Worse'n all those testy old men on CW bumbling along in 10 wpm horsecarts in a day of 25,000 wpm supersonic technology . . . and complaining about the fast drivers.

And while hams are fighting to keep bleeping at each other on CW, technology is moving ahead. In-flight phones in every seat are being tested on U.S. Air, Northwest and American Airlines. These phones use digital technology to encode the voice, plus they'll work with your laptop computer and even handle fax right there in your airline seat. You'll be able to make plane reservations, page friends on the ground, get stock quotes, read news headlines, look up flight schedules and so on. Now tell me again about how CW can get through when all else fails . . . I need to hear about that again to retain my failing faith.

Saudi Arabia

The Arabs, not just in Saudi Arabia but in all Arab countries, have one whale of a problem. And it's a problem which is going to make for wars for a long time to come.

If one asks how come the Arabs were way ahead in science and technology a thousand years ago and then stopped, I think the sad answer lies in their religion, Islam. Islam is against paying interest, which means that any fundamentalist Moslem society will never have the capital to grow. Few businesses can get started without borrowing money. We're talking about a religion which is anti-capitalist and thus dooms any country which is limited by it to failure . . . just as the communist countries failed.

And as if that weren't bad enough, Islam is also against technology. Science teachers in fundamentalist Islam countries find they must graduate Moslem students, whether they know anything or not. A ham visiting Saudi Arabia reports that the Aramco Saudi technicians spend their days in idle gossip and drinking tea. When something breaks they have to call an American supervisor.

I realize that it's blasphemous to question any aspect of a religion, even one which is a thousand years out of date and is keeping its believers in poverty . . . except for those families lucky enough to live on top of an oil field. I'm not suggesting that Moslems consider changing Islam, only that they stop being jealous of the wealth the rest of the world gains through technical education and using technology.

If you ever wondered why almost the only ham contacts you've made in the Middle East have been with Americans, now you know.

I've been interested in the growing number of articles about Kuwait and Saudi Arabia and their medieval societies . . . which we've just spent a few billion dollars rescuing from an old friend of theirs. I'm glad we lost fewer Americans doing it than we lose on a good night to crack-related killings.

I asked for some ham volunteers to follow our troops into Baghdad and set up some health and welfare stations. Several hams were ready to go. Alas, our troops stopped before entering Baghdad, a fact which General Schwartzkopf made plain was a bummer in his mind. It looks as though history has already backed him up. Anyway, I was very glad to see a few hams willing to pitch in to help out at their own cost.

Say, if you think I'm exaggerating about the hold religion has over there, just remember back to the Iranian mobs waving their fists at us on the evening news a few years ago. And the thousands of Iraqis doing ditto last year.

Free Cellular Calls

Well, free, if you don't get caught. I mentioned a couple years ago that most crooks were using cellular phones with altered serial numbered identification chips. The result is free phone calls . . . anywhere in the world.

A recent *Wall Street Journal* article tracked it all down to a computer hacker named Ken Bailey, who took a cellular phone apart and cracked the code. Ken, the *WSJ* claimed, was circumspect about it. He made bogus chips, but built in a security system so no one could make a copy of his chip and use it. They'd have to come to Ken for chips.

That worked fine until Ken's computer went on the fritz one night and he asked a friend, Bob Sutton, to help him fix it. In the process Bob came across the program and, being no fool, ran off a copy. Alas, he didn't copy the security check, so when he began popping chips for others, they had no problem making further copies. The cellular industry estimates they may lose around $600 million next year to these little buggers. Hmmm, now don't you wish you'd paid more attention when I told you to learn about computers a few years ago?

For those of my readers whose sense of humor rotted off through disuse, I'm not supportive of stealing phone services. But then I can't forget that America's wunderkind, Steve Jobs, got his start in business selling blue boxes to steal phone services from Ma Bell. And who's Jobs? He's the billionaire Apple computer alumnus. If it hadn't been for blue boxes and theft of services from Ma, we wouldn't have all those nice Macintoshes around. Who was it said crime doesn't pay? It wasn't the Mafia, that's for sure.

Zzzzzzzz . . .

Y'ever lay there awake, your mind churning, wishing you could saw zees? What would you pay for a dose of Old Doc Green's Insomnia Cure? Tell you what, if I give you the recipe and you find it works, all you owe me is one extra subscription to *73*. Fair enough?

Heck, this pound of cure is so powerful it'll put you to sleep in a dentist's waiting room. I use it to whup me into the Land of Nod on airplanes . . . something I never used to be able to do. We're talking industrial strength here.

No, it's not addictive. No, it doesn't have any bad side effects. No, it's not hypnotism . . . though that'll work pretty well too. Nope, what I've got is a system that's so simple and so incredibly obvious that you're going to be annoyed that you didn't think of it yourself.

Okay, I'll stop teasing you and let you in on the big secret . . . but don't forget the price. Once you've learned how to do this and you find it works like magic for you, which it will . . . heck, it can't fail . . . you owe me an extra *73* subscription. That means you're going to find another ham and get him or her to subscribe . . . or buy a gift subscription for a DX ham who can't afford one. If this is too hard a bargain, please stop reading right here. A deal is a deal, right?

Here's how it works. You're going to set up a habit pattern which will automatically put you to sleep. Yep, a simple Pavlovian stimulus/response deal. If you aren't up on Pavlov, it's because you have been poorly educated. And don't blame the schools, you're the main one responsible for your education, not our lousy schools.

From now on, every time you go to bed at night get into the same sleeping position. Find a comfortable position and use that every night. You're going to establish a habit. You're going to have your body recognize this position and start generating endorphins as soon as you assume the position.

No, that isn't all. That's not going to knock you out in an airline seat where you can't get into that position. But it's a way to get started with training your mind/body to go to sleep.

Step two is to choose a sound to repeat a few times every night as you go to sleep. Pick something euphonic like umm, oom, ooze, ahm, ease, or moo. Just say it a few times as you drift off to sleep. Hey, this isn't going to work if you try to use it to get to sleep when you are keyed up. Start breaking in the system when you are tired and will naturally go to sleep. We're building a habit pattern here.

After a few weeks the combination of falling asleep and the sound you've chosen as a mantra will be tied together and you'll find that your mantra will, more and more, help you fall asleep, even in circumstances where you'd ordinarily find it difficult or even impossible.

Continued on p. 77.

Number 28 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

Field Day has come and gone, and I didn't make it to Colorado like I did last year. I did get an invitation, but I had to refuse because my schedule just wouldn't permit it, though I did make it to the High Country in July.

My big ham project for the summer was to make my one-legged 160m dipole into an honest two-legged 160m inverted vee. A very tall tree between my house and the property next door became available for the center support, so out came the bow and arrow, and it happened. What a difference!

It appears that we will start hearing from Australia again in the near future. David Horsfall VK2KFU has volunteered his services to bring us the news from Down Under. David is a member of the WIA, and during the last few years has served on Executive. He produces the weekly broadcasts for the WIA (VK2 Division). Welcome, David. We look forward to your contributions.—Arnie N1BAC

Roundup

Colombia The Colombian League of Radio Amateurs is sponsoring The Colombian Independence Day Contest. The contest will be held between 0000 and 2400 UTC on Saturday of the third weekend in July (July 20, 1991). For further information, contact: Liga Colombiana de Radioaficionados, The Colombian Independence Day Contest, P.O. Box 584, Bogota, Colombia, South America OR see the the 73BBS 73 International SIG (Colombian Independence Day Contest).

India VU2RG is a Silent Key. Who, might you ask, is VU2RG? He was in the limelight for many years, but certainly was not known for his work as a ham. VU2RG was Rajiv Gandhi, prime minister of India from 1984 to 1989, grandson of Hawaharlal Nehru, India's first prime minister, and son of Indira Gandhi, who ruled India for 15 years.

Gandhi, leader of the powerful Congress Party in India, was killed by a female suicide assassin as he was attempting to regain the position that he had lost in 1989.

The National Institute of Amateur Radio (NIAR) and the Bangalore Club Station, VU2NRJ, are sponsoring the Garden City Award. This award is continuous after March 1, 1991, and further information may be received from NIAR-HQ at Hyderabad, by writing NAGESH (VU2NUD), P.O. Box 5624, Bangalore-560010, India; OR you can download the information from the 73 International SIG (Garden City Award).

Japan From the JARL News: The Amateur Radio Festival, popularly known as Ham Fair, will be held on August 23, 24, and 25 this year under the auspices of JARL at the Tokyo International Trade Center Annex in Harumi, Tokyo, the same location as last year.

The theme this year is "Freshen-up Ham Life" and the catch-phrase is "Let's meet at Harumi under the glittering sunshine." A special event will be "Multi-band Know-how." Bring along a friend and join in the fun and frolic!

Switzerland From the International Telecommunication Union (ITU) Press Release: The most recent press release published in connection with the 23rd World Communication Day includes a feature by the United Nations Disaster Relief Office (UNDRO) on disaster preparedness and relief telecommunications. Included were the views of the Secretary-General of the League of Red Cross and Red Crescent Societies on the need to enhance the quality of information in disaster relief operations.

Key issues concerned taking a critical look at the quality, as well as the quantity, of information, facing up to the general failure of disaster agencies to communicate adequately with disaster victims; appreciating the mass media's involvement in disaster situations and ensuring that the media reflects the nature of disasters accurately.

Information scientists stress six attributes of useful information: clarity, accuracy, significance, timeliness, adequacy, and validity. Those dealing with communications from disaster areas must keep these attributes foremost in their thoughts if their information is to do any good.

USSR A quick note came from Serge UA9SAW on some of his DXpedition activities. He mentioned two DXpeditions: on 6–16 September 1989 as UL1K/UA9SAW in OBL024, and on 4–21 September 1990 as UH1E/UA9SAW from OBL044. Please QSL direct: Serge P. Klyushnikov, UA9SAW, P.O. Box 13, Gaj, Orenb. Obl., 462630, Russia, USSR (CCCP).

The following letter was received from Ken Carpenter KC4UG: "I always enjoy '73 International.' Since I have learned to speak Russian I have made many friends there, and receive a great deal of information about their ham activity. I plan to attend the hamfests in Leningrad and Omsk in August of this year. *[Say hello to Gene (Gennady) UA9MA and all the other hams from all of us at 73. We loved the awards he sent to us several years ago which were printed in this column.—Arnie]*

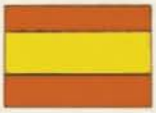
"I received the following from Serge EKØKBZ, 4K4/UAØKBZ and UAØKBZ. Serge operated EKØKBZ for the Big Circle Dog Sled expedition in 1990. He made over 6,000 contacts, but only received 200 QSLs because he couldn't receive his cards via Box 88 in Moscow. He is located in remote Cape Schmidt in the Arctic.

"His card is a beautiful three-part QSL with scenes of the sled teams in the arctic, the best I have seen from the USSR. He wants QSLs direct with two IRCs or, better yet, one green stamp. His address is: Serge Tsybizov UAØKBZ, P.O. Box DX, Cape Schmidt, Magadan Oblast, 686830 USSR.

"He also sent me information about the Soviet callbook. It has over 20,000 addresses and more than 400 local Russian QSL bureau addresses. It is available from: Giusppe Iannuzzi I8IYW, P.O. Box 5083, 80144 Napoli, Italy. The cost is $6 US, postpaid air-mail.

"The mail from Russia is getting slower each month, and a card via their bureau is almost impossible. At one time I was receiving mail from Russia in two weeks, but now it takes up to two months, air mail!

"I sent Mike UA9MI an MFJ packet TNC last year. He and Gene UA9MA are on HF packet from Omsk, Western Siberia. They are the only ones from that area on packet at this time. 73, Ken KC4UG."



SPAIN

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Islas Cananas, Espana

Carnaval Gaditano

Hi to Arnie and All. Paco EA7CZR sends some QSL cards from the Carnaval de Cadiz, and an announcement he would like presented to our readers

I am Francisco Ramos EA7CZR and EA7FR, from the city of Cadiz, southern Spain. *["Paco" is short for "Francisco."—Eds.]* I am enclosing some QSL cards from ED7TDP, a special call used during the Mardi Gras in Cadiz. The meaning of TDP is Tacita De Plata (silver cap), the nickname of Cadiz city.

The Union de Radioaficionados de Cadiz, Seccion Local de la URE, (the local section of the Cadiz Radio Club) is sponsored by the Fundacion Gaditana del Carnaval (Mardi Gras Fundation) from the EXCMO, Ayuntamiento de Cadiz (City Hall of Cadiz), since 1985. Every following year, the OMs

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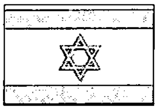
Photo A. The 1991 QSL card sent to contacts with ED7TDP during the Carnaval Gaditano (Mardi Gras in Cadiz).

from Cadiz have used this special callsign on the air.

During 1991, we awarded the people who sent to us confirmation of contacts performed with ED7TDP, during three consecutive years in SSB/CW or mixed, an engraved medal to thank them for being with us every year during the Carnaval Gaditano. 73, Paco EA7CZR. *[Each year's QSL has a different beautiful poster."—Arnie]*



ISRAEL

Ron Gang 4X1MK
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D.N. Hanagev 85530
Israel
PACKET: 4X1MK@4X4SV.ISR.EU

Techsat I—Israel's First Hamsat

AMSAT-Israel, in cooperation with the Technion University of Haifa and the Asher Institute for Space Research, is building an amateur radio satellite. Most of those working on the bird are volunteers and students giving of their spare time in this on-going project to build smart satellites for the amateur radio community.

Techsat I is to support digital store-and-forward communications with an onboard packet BBS. The bird will fly in a polar low-earth-orbit (LEO) approximately 450 miles up. Because of the polar orbit (similar to the Microsats), everyone on earth will have a shot at the bird.

Two transmitters are planned for both telemetry and downlinking, and will work on 435 and 29 MHz. Uplink receivers will have five frequencies on 145 MHz, five channels on the 1260 MHz, and yet another five frequencies on 2400 MHz. As well as supporting PSK and FSK, the system will have FM AFSK capabilities, meaning that stations equipped with standard packet TNCs will be able to access the orbiting BBS. (PSK, Phase Shift Keying, which requires a special modem on the TNC, is much more efficient and effective for hamsat packeteering, but the FM AFSK mode is being provided to give "beginners" a taste!)

Hams involved in the project are Peleg Lapid 4X1GP, system designer, 'Oved Ben Aroya 4X4LS, software designer, and Shlomo Menuhin 4X1AS, IARC/AMSAT-IL coordinator.

Launch is planned for 1993 on an Ariane rocket. A scientific experiment, possibly in radio navigation, is also intended. Work at the present is still in the planning stage, but is reported to be in high gear. Wishes of Godspeed to the folks at the Technion University working on the project, with the hope that they will be successful in providing the international amateur community with another reliable hamsat. 73

Never Say Die

Continued from p. 74

Pavlov rang a bell every time he fed his dogs. After a while he found that just ringing the bell started their digestive juices flowing. So why not use this mechanism to help you go to sleep? It works! And it doesn't take very long to build this new and helpful habit pattern. There's no downside to this.

I used to hate long airline trips because I'd sit there wanting to sleep and just sit there hating every minute of it. Now I can doze off in seconds and wake up an hour later refreshed. Yes, I suppose I cheat a little. I do take along a sleeping mask to block out the bright lights or the movie. And I put in a pair of those foam yellow ear plugs to cut down the noise from the people talking across the aisle. And I take along an inflatable pillow that goes around my neck. The whole works fits into a small bag which I carry on with my laptop computer and reading material. The pillows are sold through several mail order houses for a few bucks and they work beautifully. I have the same travel package in my van so I can grab a few zees on trips. No, I'm not driving.

Most of us are able to get to sleep most of the time without any great problems. But every now and then we find that our mind is racing and we just lay there twisting and turning. This can be particularly frustrating if you've got an important day ahead and you really need that sleep.

Start building your sleep habit pattern so it'll be there when you need it. I've been taking afternoon naps for years. I find they make it possible for me to work smarter and harder late into the evening. This zonking system is priceless for getting me to sleep in a few seconds when I take a nap. I assume the position, say the word, and I'm out for almost exactly one hour.

By the way, you can train yourself to sleep exactly as long as you want too. The mind has an amazing ability to keep track of time. It works on a subconscious level. When I go to sleep I decide when I want to wake up...45 minutes, an hour...and bingo, I'm awake...usually within the exact minute. It works for long naps too. When I have to be up at a specific time and set my alarm, I almost always wake up about a half minute before the alarm goes off.

How much sleep should you get? That's a habit too. Some people get along fine on four or five hours. Others are habituated to eight to ten hours. I've got too much I want to do to waste time sleeping that isn't needed, so I generally go about five hours at night and one in the afternoon. Works for me.

Try my system and it'll work. Then start looking for a ham or prospective ham who needs a monthly shot of enthusiasm and get him (or her) to subscribe to *73*. I positively refuse to get upset if you find this so helpful that you feel obliged to wrestle up two subscriptions. 73

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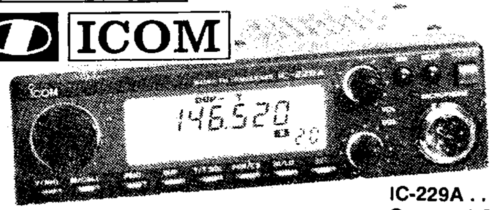

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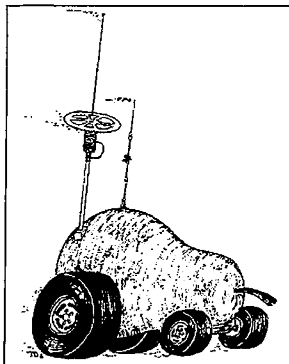

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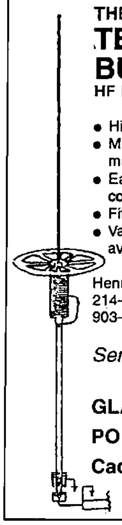

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ASK KABOOM

The Tech Answer Man

Michael Geier KB1UM
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Keep on Switchin'

Last month, we were exploring switches and controls. Let's finish that up and move on to a new topic.

Microswitches really aren't all that small by today's standards. I suppose they must have seemed tiny compared to other switches when they were first introduced. We continue to call them microswitches, partly out of tradition, but also because a company called Microswitch, Inc., makes many of them.

The distinguishing characteristics of a microswitch are that it is rectangular and it is operated via a small plastic button near one end. Often, there is a lever arm mounted on the switch body, permitting a small force to operate the switch. This type of switch makes a distinctive "click" when it is pressed, and another when released.

The internal construction consists of several strips of metal arranged to provide a "snap" action which presses the contacts together. This action is what causes the click. I've seen a few microswitches with broken strips and a few with burned or corroded contacts. If there's no click, the strip is gone. If you hear the click but get no connection, suspect the contacts.

Although it is sometimes possible to break a switch open and clean burned contacts, it really isn't worth it. These switches are nearly all of one or two designs, and are easily replaced. In fact, Radio Shack sells two versions. And, of course, the mail order outlets have them. Don't waste your time—get a new switch!

You're Relay Switching Now

Relays, of course, are just magnetically operated switches. In my experience, they are among the most trouble-prone switching devices of all. Although coils can open now and then, the usual problem is poor connection at the switching contacts. The techniques for general contact cleaning I discussed last month apply here as well. Also, try soaking a piece of paper in contact cleaner (*not* the corrosive acidic kind) and pulling it between the contacts while you hold them closed. You may be surprised at how much gunk is deposited on the paper. In addition, check to make sure that the arms on which the contacts are mounted are not bent or sagging. Sometimes they just don't exert enough pressure.

I've had some frustrating times with relays. I've wasted more than a few hours trying to get an intermittent relay to work every time. Especially when low signal levels are involved, such as in TX/RX switching, the connection has to be very good, and some old relays just won't do it no matter how hard I work on them. If you run into this, try to get a new relay; it just isn't worth the misery to try to fix it.

By the way, always check the solder joints where the relay connects to the board. The heat-sinking effect of the large connections sometimes causes them to be soldered poorly at the factory. They may last for a few years, but they will eventually go. Unfortunately, the effect exactly mimics intermittent relay contacts, and it can drive you nuts.

Truly Micro

Among the smallest switches in use today are DIP switches, so-named because they conform to the Dual Inline Package specs for integrated circuits. Consequently, they look like ICs except that there's a row of switches on top. With the exception of some early CTCSS encoder applications, these switches will be found inside the rig, on the board.

They are intended for set-up parameters, so they don't see lots of switching action. Nonetheless, they occasionally can go bad. Some are slide switches while some are rockers, which are essentially toggle switches. In any case, these things are sealed, and they are just too small to mess with.

You can replace the slide type with a toggle unit, and vice versa, but always check *any* replacement with an ohmmeter, even if it has the same type of switches, to be sure the pinout is the same. Some DIPs may be wired quite differently and some may even have double-throw contacts.

Dits and Dahs

There is one kind of switch we hams are especially familiar with: the Morse code key. Its construction is obvious. Used with electronic keyer circuits and most solid-state rigs, the contacts handle only low power and rarely require more than a little cleaner-soaked paper pulled through them now and then.

Tube rigs (even those whose only tubes are in the driver and final stages), however, can put far more stress on the contacts, because they may be switching as much as 100 volts. If the rig won't key properly, or it sounds lousy on the air, check the key contacts before you dig into the circuitry. A good, low-resistance contact may be essential for proper transmitter operation, and even a few tens of ohms can cause trouble.

Louder, Please

Ah, potentiometers. I often wonder what sadist thought those up! No other kind of control causes as much trouble. Basically, a potentiometer (pot) is just a resistor. To make it variable, a wiper is rubbed across the resistance element. The closer it is to the element's connection, the lower the resistance.

Actually, pots have three connections, with one end of the element being ground and the other being the signal to be sampled. The wiper samples the signal and feeds the next circuit stage. When the pot is not working well, the symptoms can range from the obvious, such as a scratching sound in the audio, to the perplexing, such as an out-of-lock frequency synthesizer, depending upon the pot's intended function.

In fact, when you're faced with a difficult problem, it pays to check any pots or trimpots (small pots meant to be set and forgotten) with a scope to be sure they are not open. *Don't* turn them, though! Once you do, you have no way to set them back to their original positions.

Where's the Rub?

There are two basic kinds of pots: wire-wound and film. Wire-wounds, which have limited resolution (because the wiper can only make contact once per turn of the wire) as well as some inductance, are generally used only when their superior power-handling capabilities are required. The vast majority of pots is of the film variety.

In these units, the resistance element is a carbon-based film which is painted on a nonconductive substrate. The wiper, of course, rubs this film. Because the wiper rubs the resistance element, it is subject to the problem shared by other mechanical connections: poor contact. Unless the pot is being used in some power-handling situation, which is unlikely, the cause of the trouble is almost certainly *not* a burned contact! More likely, the problem is simple wearing away of the resistance element, or dirt or (gasp) cigarette residue clogging the works.

Unless the film is badly worn away, a shot of contact cleaner usually will restore the pot to fine condition. The trick is getting the spray into the pot. Most larger pots, such as volume and squelch controls, have slots near the solder contacts into which you can spray.

After spraying, rapidly twist the pot through its control range to disperse the cleaner and rub away the dirt. Although some smaller pots and trimpots can be sprayed, many are sealed. In that case, you are going to have to get a new part. Also, you'll be faced with the problem of setting it where it belongs. If you match the pointer visually with the old one, you should be close.

Of course, that won't work in the case of multi-turn trimpots, which have only a screw exposed. Unfortunately, you can't read the resistance of the wiper connection because that is what is not working in the first place! In any event, replacement of a trimpot is always going to entail readjustment. Luckily, trimpots rarely fail, because they rarely are moved.

Finally, before you suspect a pot, be sure it really is a pot! On some of the new rigs, the RIT, IF shift, and other controls may be optical encoders. This seems to be a trend in Japanese HF rigs, and it's a welcome one. The encoders are much more reliable than pots ever could be.

Well, I think that about does it for switches and controls. So now, let's turn our attention to a letter.

Dear Kaboom, *I have a Radio Shack HTX-100 mobile rig that I want to use as a base rig. I don't want to use a DC power supply. Is it possible to use a car battery at home, provided I charge it when it runs down? I tried to ask around, but I don't know any hams yet (I'm still studying for my license) and no one else seems to know.*

Signed,
Homin' In

Dear Homin,' Sure, why not? A charged car battery will run your 10-meter rig just fine. I can't imagine, though, why you would not prefer to use a power supply—it would be a lot easier. If you do use a car battery, be sure to properly ground the rig, just as you would if you were using a DC supply. And put a large electrolytic capacitor, say, a few thousand microfarad, in parallel with a 0.1 µf cap across the battery.

Of course, watch the electrolytic's polarity and be sure to use one rated for at least 25 volts. Also, beware of toxic (and possibly explosive) fumes from the battery. These things were never meant to be used indoors, and a spark, soldering iron, or cigarette lighter could set off the hydrogen they produce. The acid fumes can be toxic, too.

Finally, car batteries are not deep-cycle; they are meant for short starting periods followed by immediate recharge. If you run yours way down between charges, it will not live long. If you anticipate such use, get a deep-cycle marine battery, as it will be designed to withstand it. Best of luck and see you on the band!

Dear Kaboom, *My Yaesu FT-208R seems to have amnesia. It works fine, but when I shut it off, all the memories disappear. It's getting to be a pain to re-enter all my local repeaters. Where's my data going?*

Signed,
Forgetful

Dear Forgetful,

To that great databank in the sky, that's where! You have a classic case of "dead lithium battery-itis." '208s are old enough now that the batteries are finally starting to go. It's just a plain-Jane 3-volt lithium cell, but it has solder terminals on it, so you'd better order one from Yaesu, unless you know of a local source (I don't). The battery is located on the microprocessor board, just behind the speaker. You'll have to pull the board, so be careful not to break the wires going to the keypad. And naturally, be sure to get the polarity right—micros don't appreciate reversed voltage!

And see you all next month.

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton CA 92633

RDF Fights RFI

Even if you don't enjoy competitive transmitter hunting or search/rescue work, you will probably need to go DF-ing at some point. Most likely, your target will be some sort of non-ham RF interference (RFI).

Over the years, I have searched for dozens of noise sources, from aquarium heaters to gas oven thermostats. One of my most interesting (and frustrating) RFI adventures took place about two years ago in Stanton, California.

This story is true, but I'll leave out actual names, calls, and addresses. The victim (we'll call him W6XYZ) loved rag-chewing and daily nets on 75 meters. One day, a strange signal began to crowd him out. It was a very unstable carrier, moving up and down the band and occasionally disappearing. Most of the time, the signal was 20 dB over S9 and right on top of his favorite net frequency near 3900 kHz. By the time I got involved, W6XYZ's block had been checked out by the power and cable TV companies, who could not find the source of the signal in their lines.

Looking For Harmonics

The first rule of RFI-busting is to search on the highest practical frequency. At 80 and 40 meters, long power lines and other objects reradiate signals and distort RDF measurements. Null-type antennas are the norm. At VHF, gain antennas are practical, and long radiators are less common.

I set up a general coverage receiver and calibrated RF attenuator in W6XYZ's shack and tuned from 150 kHz up, making a chart of all RFI carriers by frequency and relative amplitude. There were a lot of them, but they all sounded different. The strongest (20 dB above the 3900 kHz spur) was at 3400 kHz.

Harmonics at varying levels (11 to 33 dB down) were present every 3400 kHz all the way up to 30 MHz, the top of the receiver range. I figured that the 15th harmonic at 51.05 MHz should be strong enough to detect. If so, my 6 meter T-hunt "Shrunken Quad" (see "Homing In" for January 1990) could DF the source.

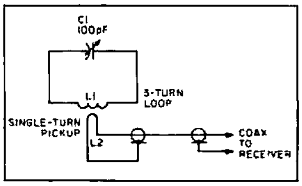

Figure 1. Schematic diagram of the 75/80 meter loop for RDF.

A few days later, my wife April and I were back with the van set up for 6 meter hunting. The 51 MHz harmonic dropped off rapidly as we drove away from W6XYZ's home. All the bearings pointed right back to his house. Using a Yaesu FT-690R and its whip, we sniffed around the house and found the source of the 51 MHz harmonic. It was the solar heating control unit in W6XYZ's own closet!

Gleefully, we turned off the controller and ran to the shack to check the HF bands. Sure enough, the noise at 3400 and its harmonics had stopped. In fact, the spectrum was very quiet—all except the signal at 3900 kHz. It was as strong as ever. Rats!

Building a Loop

So, the direction finding had to be done on 75 meters. We didn't have the time or the motivation to do anything fancy. All we needed was an indication of which way to go. A loop antenna was the clear choice.

The receiving loop (L1 in Figure 1) is three turns of #18 AWG solid enameled wire, resonated with a 100 pF air variable capacitor (C1). Signal snagged by this outer loop couples to the coax via single-turn inner loop L2. Inductive coupling works much better than direct coax connection to the outer loop, which would upset the balance and cause poor nulls.

Photo A shows the completed antenna on the T-hunt van. The frame is Class 125 (thin wall) PVC pipe, 3/4-inch trade size. That matches with my standard mast system for hunting on other bands (see "Homing In" for July 1989). Note that the coax bows slightly so it does not touch the bottom of L1.

To build this loop, cut the top and side PVC frame members and assemble them into a slip-type PVC cross-fitting. Bond them with PVC pipe glue. Use a 5/64-inch drill bit to make individual holes through the mast and cross pieces for the three large loop wires. Space the turns of the large loop about 3/16 inch apart. Holes for the large loop wires are 16 inches from the center of the cross, and holes for the inner pickup loop are eight inches out.

Tuning the antenna is easy—just connect it to the receiver and peak the background noise on the hunt frequency by adjusting C1 with an insulated tool. Keep yourself and any objects clear of the loop during tuning.

Check out your loop on a local (ground wave) signal before going RFI-hunting. The pattern of small (less than 0.08 wavelength) loops like this has two broad peaks (in the plane of the loop) and two sharp nulls (looking through the loop). The nulls are easiest to use and most accurate for RDF.

The ambiguous nulls 180 degrees apart would cause problems in a long distance T-hunt, but not in a neighborhood RFI search. Just take several "fixes" from well-spaced locations around the area and plot the lines of bearing on a map. They should intersect near the interference source. Follow the bearing lines and home in.

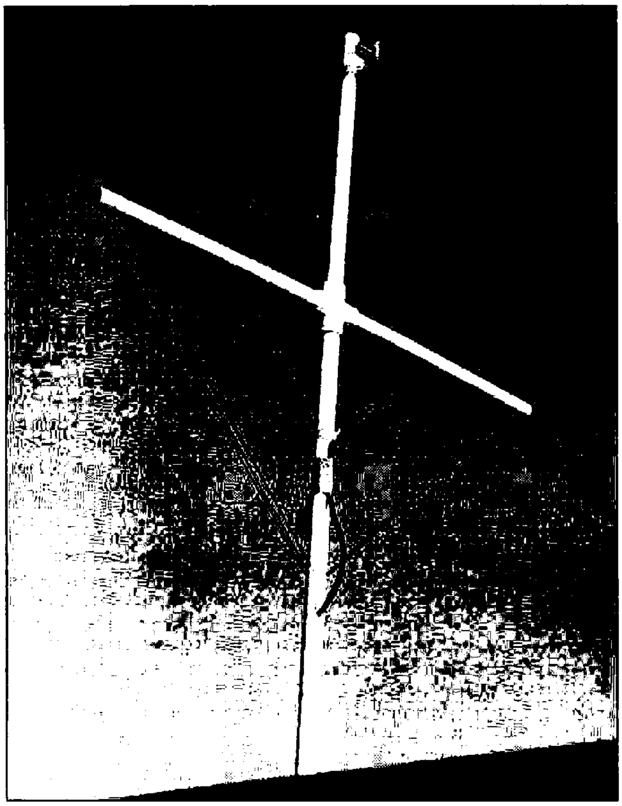

Photo A. Not fancy, but functional, this simple loop on a PVC pipe frame will ferret out interference sources on 75/80 meters.

If necessary, you can resolve the 180-degree ambiguity by using the directivity of a mobile whip on your vehicle. Typical 75-meter whip systems show higher S-meter readings in the direction of the greatest amount of ground plane. For example, if your whip is on the left rear bumper, it will give a slight amount of enhancement to signals coming from the right front.

Be sure to remove your 75-meter whip from the car while DFing with the loop. The proximity of a resonant whip causes inaccurate loop nulls. Similarly, avoid taking bearings when directly under power lines, etc.

If you expect to hunt very strong signals and your receiver does not have a wide range RF gain control, connect an RF attenuator between the antenna and the receiver. Do not transmit into the loop or attenuator. Unplug the mike and key to prevent accidents.

The loop will not give good nulls close-in if a long power line or the wiring of a house radiates the RFI. For example, let's say you are 200 feet away from the center of a radiating overhead power line 400 feet long. The difference in azimuth from the left end to the right end of the line is 90 degrees.

When you attempt to null the left end, the right end lies in the peak of the loop response. No matter which way you turn the loop in this case, there will be some signal to "fill" the null in the pattern. So, when you get too close to get good nulls, switch from the loop to a whip and move around, looking for the highest S-meter readings.

Closing In

A few days later, we went off to Stanton to snoop around with the loop. RDF bearings and S-meter readings showed the hottest area to be about two blocks away from W6XYZ in a cul-de-sac. The curbside signal was strongest in front of House A, and almost as strong in front of House B. Both were fed from one overhead power line in the rear.

House A's owner was not at home, so we rang the bell at House B. When I explained the problem, the family was very receptive and let me probe the back yard with a Sony ICF-7600 portable shortwave set. The power drop to the house and the breaker box were radiating plenty of 75 meter RF.

We found no obvious "hot spots" inside or outside. I asked if I could turn

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off the House B main breaker for a minute. They consented, I flipped the breaker, and the noise continued in the portable receiver.

By now, the owner of House A was home, but he was not interested in W6XYZ's plight. "Hams cause all the TV interference problems," he said, "so I don't care if I cause a problem for a ham."

I told him I just wanted to check the incoming power line in his back yard.

"Come back with the Edison Company," he replied, and asked us to leave.

When I told W6XYZ about our experience, he began to despair. He said that he was thinking of selling his house and taking a long trip in his RV. I wasn't ready to give up yet.

To be absolutely sure that House A was the culprit, I did a "porch light survey," reading the signal strength of the 3900 KHz radiation from the front porch light wiring of every house in the neighborhood on the Sony receiver. Sure enough, the light at House A radiated 20 dB more signal than any other.

I tried one more time at the door of House A, this time with W6XYZ along.

Despite our best efforts at diplomacy, the owner would not let us into his house or yard, nor would he turn off any breakers for tests.

FCC Gets Involved

I gathered all the RDF and porch light data. Then I put together some maps of the neighborhood, showing how House A was clearly the RFI source. I wrote a cover letter to the engineer-in-charge of the Los Angeles area FCC office, detailing the problem. I pointed out that the 3900 KHz radiation from House A was so great as to be a violation of FCC Part 15, that the owner was uncooperative, and that FCC intervention was needed.

Less than two weeks after I sent the letter and data, the FCC sent a letter by certified mail to the owner of House A, telling him that he was in violation of Part 15 and had 15 days to correct the problem.

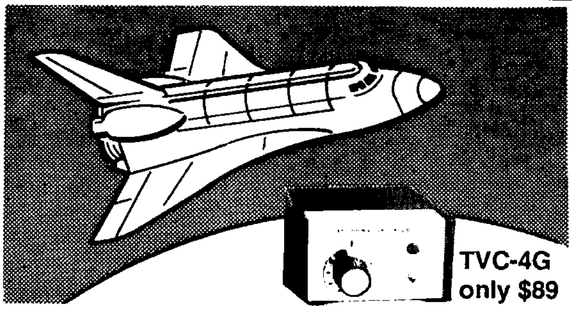
Apparently, that really lit his fuse. I heard that he promptly drove to the FCC office and railed against W6XYZ and me. Fortunately, the FCC stood firm.

From that point on, my information is secondhand. I heard that circuit breaker checks showed the QRM definitely came from House A, and that a bad power line ground and loose cable TV hardware were found and fixed. But the 3900 kHz radiation continued.

Two months later, I heard that an FCC engineer had located the RFI source in the house, and ordered it to be repaired. But by that time, W6XYZ had sold his house and was moving out.

Apparently, the malfunctioning device never got fixed. I drove down W6XYZ's old street last week, and heard an unstable carrier on 3900 kHz. If you like 75 meters and are thinking of buying a home in Stanton, call me first.

AMATEUR TELEVISION



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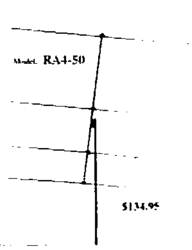

ELECTRICAL SPECIFICATIONS:

Measured gain	6.25 dBd
E-Plane beamwidth	51 deg
H-Plane beamwidth	65 deg
Bandwidth	1 MHz
SWR	1.0:1 typical
F/B ratio	30 dB
Maximum Power	400 Watts
Impedance	50 ohm

MECHANICAL SPECIFICATIONS:

Length	[illegible]
Boom	[illegible] Aluminum
Elements	[illegible]
Element mount	[illegible] Aluminum
Wind survival	[illegible] MPH
Mast	[illegible] diameter
[illegible] Stainless Steel Element Hardware	
Coax connector	Waterproof N type
Weight	[illegible]

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ATV

Number 25 on your Feedback card

Ham Television

Bill Brown WB8ELK
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Simulated ATV Satellites

Students at Franklin Community High School (Franklin, Indiana) have a very exciting course offering. Each year juniors and seniors have the opportunity to take an Aerospace Technology Class (wish I had one of these when I was in school!) One particularly fascinating part of the course is the satellite simulation experiment. They get to design, build and test their own satellite.

This year, they decided to design a weather observation satellite. Since launch opportunities are limited, they elected to send their satellite to the edge of space using a weather balloon. To study cloud patterns, they incorporated a live TV camera and ATV transmitter so they could receive live images directly in their classroom mission control center. In addition, they designed two different radar reflectors to test their visibility on FAA radar screens.

Using components donated by Bob McAuliffe W9PRD from one of his pioneering ATV balloon experiments (June 1988), and with guidance from Chuck Crist WB9IHS and teacher Doug Craig, the students designed the satellite payload for maximum stability. They even performed wind tunnel tests and drop tests of the parachute recovery system. A series of classes were held to discuss the theory behind the system, go over the design goals, and then proceed to build the payload.

The payload consisted of a Wyman Research ATV transmitter, a Uniden VM-110 TV camera, a 2m FM transmitter with CW ID and a 10 meter CW beacon. Callsigns on the payload were: ATV—WB9IHS, 2m—W9PRD, and 10m—WB8ELK.

The components were mounted in a hexagonal styrofoam package with a swivel mounted on top. This aerodynamic design helped maintain a very stable camera platform for excellent ground imaging. One nice touch that I particularly enjoyed was the TV camera lens protector—half of a pair of sunglasses!

Liftoff

After thoroughly testing their satellite, the class was ready to fly. After a couple of weather delays, they were finally able to launch their balloon satellite at 1:15 p.m. EST on April 21. The students gathered around their ATV receive station and had a blast riding along with their balloon as it provided them with spectacular aerial views of their school as it was rapidly left behind.

The package disappeared into the clouds and nothing could be seen for awhile from the video camera. Soon the balloon system was above the clouds and they could observe the cloud tops from an ever increasing altitude. They now had a functioning weather satellite!

Quite a few area amateurs pitched in to help make this a successful event. Ron Pogue KD9QB and pilot Ken Jessup actually circled over the launchsite in a small plane and transmitted the takeoff through the Indianapolis ATV repeater. Dozens of midwestern hams checked into the tracking net (operated by Emmett K9YKX) with direction reports throughout the 2 hour flight. Excellent video (although of cloud tops) was reported over a several state area. Although the 2m beacon died at about 12,000 feet, it was heard as far away as Wisconsin!

Success!

The Indianapolis foxhunt group also provided their headings as they drove along under the payload. The students took these beam headings and plotted them on a large map of Indiana. They learned a lot about direction finding and were quite accurate in locating the package during its journey. After reaching 95,000 feet, their weather satellite could see a large area of Indiana below. At this point the balloon burst and the package parachuted back to Earth. Their map plots were so accurate that the chase plane was able to actually see the package as it was parachuting down and watch it land in an open field near a small road. The package had drifted just over 28 miles to the southeast to land near the towns of Westport and Alert.

The Indianapolis foxhunters were so close that they could see the circling plane. Larry Oaks WB9YAJ and Paul Bohrer W9DUU (two veteran balloon trackers) arrived at the scene just a few minutes after it landed.

The radar reflector experiment was successful. They actually flew *two* balloons. One of the reflectors (The Pizza Hut design—named for the sign it was designed around) flew on the main payload. The other reflector (a very large garbage can design) flew on a small, very slow-rising balloon that was launched at the same time as the weather satellite balloon. Both reflectors were made out of metallized Mylar. Controllers at the Indianapolis FAA center successfully tracked both balloons during their flights. Although there was no radio beacon on the small balloon, the controllers followed it almost to the Kentucky border. It was later found and returned!

Photographs from the Edge of Space

In addition to the live video experiment, I sent the students a 35mm film camera to attach to the side of their satellite. Even though the temperatures could drop down below −60 degrees, I hoped the camera would survive to take some really spectacular high definition color photos.

After browsing through the local photo store (Peterborough Camera), I found the perfect candidate, the Samsung AF-SLIM. This little gem is a full-featured pocket camera with a built-in autowinder and timer (30s, 60s or 10m). Another nice feature was a lens system that would pop out of its lens cover to take a picture and safely retract back into its protective cover (ideal for the harsh environment in the stratosphere!).

The class programmed the camera to take a photograph every 10 minutes during the flight. Since the balloon ascended at about 1000 feet per minute, they snatched a photo every 10,000 feet.

The results? Let me put it this way: When the photoprocessor in Indiana handed the photos back to Chuck

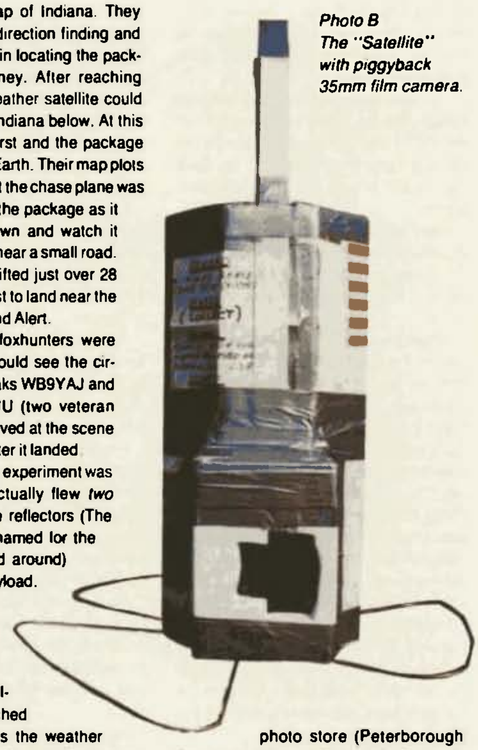

Photo B The "Satellite" with piggyback 35mm film camera.

Photo A. The Franklin Community High School Aerospace Technology Class (with satellite and radar reflectors in foreground).

Photo C. The automatic camera takes a surprise picture of balloon tracker Paul W9DUU shortly after landing.

Photo D. The Samsung AF-SLIM pocket camera can take the rigors of the stratosphere!

Photo E. 45,000 feet over Indiana.

Photo F. Stratospheric views from 75,000 feet (visibility over 350 miles). The blue layer is the Earth's atmosphere.

Photo G. The top altitude of 95,000 feet. The atmosphere is just a thin blue haze from this vantage point at the very edge of space!

WB9IHS, he said, "How'd you take these pictures? From a spacecraft?" "*. . . Well, as a matter of fact . . .*". See photos E through G for the spectacular results. Photo E was taken at 45,000 feet, Photo F at 75,000 feet and Photo G at the top altitude of 95,000 feet.

The Next Step?

The Aerospace class plans another experiment this October. This time they will design a communications satellite. At least a dozen schools across the midwest plan to use this balloon satellite to communicate with each other via a cross-band FM repeater system. The cross-band repeater will be unique in that the audio uplink to the satellite will be on 2 meters, but the downlink will be on both the sound subcarrier and on-carrier of an ATV transmitter (with live TV camera). That way, even if one of the schools doesn't have an ATV receive setup, they can tune in to the ATV center carrier on an FM receiver.

Number 26 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Cleveland Calling

She said she lived in the Cleveland area. She called the *73* offices to ask a few questions, offer a few suggestions and just to chat about amateur radio. (You'd be surprised at how many calls I get in a week from people who just want to talk about radio. They hardly ever ask for me by name, but Rose at the switchboard puts them through to me when she can't figure out who else to forward their calls to.)

We talked for a while, and I got to know a little about her. Her story is quite typical: a 1x3 callsign, licensed for almost 30 years, inactive for most of those 30 years (though always renewing the license), recently getting back into the radio hobby. She was stymied by the incredible changes in the last fifteen-or-so years. Shirt pocket-sized HTs, HF rigs costing a third of your annual salary that do everything but print the QSL card and lick the stamp, Novice voice privileges, the WARC bands, packet—all brand new to her. So many changes. So many things to catch up on.

She told me she had even lost her head and, in a fit of high tech euphoria, actually gone out and bought herself a computer.

She was easy to talk to. As good a listener as she was a talker, I found the conversation lengthening effortlessly to 10, 15, 20 minutes—sort of like those nice QSOs you have every once in a while when you actually feel you've gotten to know someone and maybe even made a new friend.

"Do you want to know the biggest change I've noticed?" she asked, as we got ready to say our goodbyes. "I can't believe the foul language and just plain rudeness you hear on the bands now. Don't these hams realize that there are people all over the world listening to them? Why isn't the FCC doing something about this?"

I explained that the FCC simply doesn't have the budget, staff or interest in acting as amateur radio's hall monitor. I told her that since amateur radio was supposed to be self-policing, it was up to her and me—and all licensed amateurs—to regulate ourselves.

There was a long silence, and I could feel the mood of the conversation turn, not to anger or self-righteous indignation, but to sadness. She and I, both of us licensed since our early teens, sharing a melancholy recollection of how things used to be.

"Do you remember when people were courteous to each other on the ham bands?" she asked.

I said yes.

"Do you remember when people actually talked to each other and got to know each other, instead of all this 'you're 5 and 9, thanks for the QSO' business?"

"Yes."

"Do you remember when you never EVER heard foul language or dirty jokes on the bands?"

"Yes, it wasn't all that long ago."

"So . . . what happened?"

The pleading in her voice indicated that this wasn't a rhetorical question. She really wanted an answer. I didn't have one for her.

"Couldn't you write something about this? You could ask people to clean up their acts. Write articles about how average hams could help clean up the bands."

I told her to go back over the last twelve issues and read Wayne's columns. He's addressed these issues over and over again.

"Don't you understand the power you have?" she asked. "Don't you understand that the ham magazines could get together and really help make amateur radio better by pointing out some of these problems?"

She became more and more insistant—more and more desperate. The conversation continued along the same lines for many minutes. The more she asked "why," the worse I felt for not being able to give her a satisfactory answer. I didn't know what to tell her, except that at least we could set a good example for newcomers by our own courteous practices. She told me she did indeed make a point of scanning the Novice portion of 10 meters and answering those young voices calling "CQ." I thanked her for that, and told her to keep it up.

The conversation was over. I could tell we both hung up with a sour feeling in our hearts: Hers for not getting the answers she was searching for, mine for not being able to provide those answers.

I sat at my desk, staring at my phone and thinking about what she had said. She had told me I had "power." She had used the old pen being mightier than the sword cliche and asked me—pleaded with me—to do something to change people's attitudes. We had both remembered when the ham bands were an island of courtesy in a brusque and brash world. She had hoped I could tell her how to return to this time. I could not. I do not have the "power" she thinks I have. Neither does Alan Dorhoffer . . . nor Dave Sumner . . . nor Wayne Green himself.

How can we get people to remember that if we do not clean up our own messes, pretty soon we will all be living in the same garbage pit?

Do any of you have an answer? There's a woman in Cleveland who needs to know. 73

Number 27 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

Winding Down

As I write (around the end of April), we have seen the solar flux dive from a 300+ value to a 130+ value in less than a month! Yes, Cycle 22 is on its way down. In August you can expect some good conditions and some fair-to-poor conditions as we move from summer to autumn. See the calendar below.

The poorest days for DX on the HF bands will be approximately the 5th–8th; the 16th–21st; and the 24th–27th. Otherwise, you may expect decent worldwide conditions—unless, of course, we get some unexpected solar flares in between these dates!

Ordinarily, the flares occur near or on the dates given as poor, so don't be too concerned about the other days . . . but be aware that Old Sol is often unpredictable.

The HF bands from 10 through 20 meters will be open on many days until well after local dark, and during the day you can expect everything from short skip to long skip. Long path DXing can take place in the early morning hours just after sunrise, and occasionally just after dark.

Use the band-time-country chart to plan your operating on the HF bands, and use the daily forecast to pick the best days for your efforts.

I've noticed plenty of times that stations will make futile calls for DX at times, and on days, when there is no hope of raising anyone! Perhaps that is because these operators are totally unaware of the forecasts or the reasons behind them. Don't try harder—just smarter! See you next month, and meanwhile, for the most up-to-date conditions in the ionosphere, listen to WWV at 18 minutes after any hour. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]		20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	—	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	—
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20	20	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN		—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20	—	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	20	20	20	—	20	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]		20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]		[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20	20	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	—	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]		20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	[illegible]	—	20	[illegible]	[illegible]	—	—
U.S.S.R.	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

Notes: (1) Possible but less usual bands: (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

AUGUST 1991

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G–F	5 F–P	6 F–P	7 P	8 P–F	9 F–G	10 G
11 G	12 G	13 G	14 G–F	15 F	16 F–P	17 P
18 P	19 P	20 P	21 P–F	22 F	23 F	24 F–P
25 P	26 P	27 P–F	28 F–G	29 G	30 G	31 G

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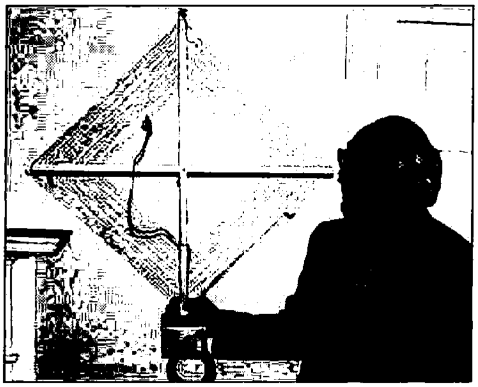

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Ever try a square pancake?
. . . see page 18.

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Are You Free?

America, "the land of the free," right? We brag to the world about our freedom and we try to convince other countries to follow our leadership. Freedom of religion. Freedom of choice. Political freedom.

Hmmm, yes, to some degree. But I have a problem with my concept of freedom and the actuality of living in America. For instance, it used to bother me greatly that as a child I had so few rights. The government said I had to go to school. They didn't say here are the reasons why you'll benefit from going to school so it's a good idea and we're making it available to you. They said either you go to school or you go to prison. Now let's run through that land of the free bit again.

During WWII the government said we'd like you to fight. They didn't put it exactly that way. It was more like you have a choice of fighting or going to prison. Yes, it's a choice. So as a kid I went to school to avoid prison, not to get an education. And I went to war and was fairly directly involved with killing thousands of Japanese (they were Japs then).

All this came to mind when I got to thinking about why I've always been entrepreneurially inclined. It's that freedom thing. When I worked for others, I found I had to give up a good deal of my freedom. When you're free you hold your head up a little higher. . . and having your own business gives you much more of an opportunity to be free.

Being an entrepreneur opens up this opportunity. It also at least gives you a chance at hitting the jackpot. . . something working for others isn't likely to do. Not many entrepreneurs make it big. Indeed, very few entrepreneurs start their own businesses with the main goal of making a lot of money.

It irks me that so much of our government is devoted to taking away my freedoms. . . that so many laws limit my freedom. And I'm not talking about the freedom to go out and bop people. You may or may not enjoy the cartoons in *Playboy*, but you should at least read their regular column on government assaults on our personal freedoms.

All this came to mind when I was considering encouraging you to give entrepreneurialism a try. . . maybe in your spare time. Freedom does have its costs. You have to work for it. You have to be responsible for yourself, which is a responsibility many people will go to lengths to avoid. One good aspect of slavery is that someone else is responsible. You have to do what they say, when they say. But in exchange you normally get food, shelter and a retirement plan.

If you're interested in giving freedom a try and would enjoy working part time out of your home, I'm planning on looking for some sales and service help in your area. Selling what? Magazines and compact discs mostly.

You'll need a car and some experience in bookkeeping and selling. And you'll want to be fairly near an urban area where there are record, musical instrument, hi-fi, and book stores. I'd prefer it if you don't smoke (so you won't be sick so much of the time or drop dead just as you get your territory really cooking). I don't care how old you are, what race, color or sex. Oh yes, one more thing . . . you need to be nuts about music. I don't want to hear from people who are just looking to make a buck. I need people who will have the time of their lives and be in love with the product.

What's involved is the distribution of about 10 monthly magazines and 2,500 compact disc titles (so far). It hasn't much to do with amateur radio right now, but if we can get the ham industry growing a bit, we might be able to expand into that. The no-code license seems to be doing better than I expected, so I'm optimistic. But for now the music business is roaring along—so why not ride the faster horse? It's an $8 billion American market and growing fast. . . and I publish the leading magazines in the field.

Well, I could go on at great length, painting beautiful pictures of wealth and happiness, but I don't want to interfere with your normal depression or trigger an outburst from the totally defeated contingent who somehow blunder into my editorials.

The time was when being a rep for amateur equipment was a great job. That was back before the Great Ham Crash of 1964 when we had over 850 ham stores around the country and they were selling several times as much ham gear as today.

Heath was the last of the old-time ham equipment companies. When they stopped advertising in *73* I knew that was the beginning of the end. Remember their old Hot Water rigs? They were great little single-band SSB rigs which sold for $100! I used 'em in a number of rare countries and handled huge pile-ups. Alas, without the Japanese market, which is about five times the size of ours, it's almost impossible to stay in the ham business these days.

Well, it's your spare time, so you invest it the way you think best. If you're working for someone else and not so happy with your work that you can hardly wait to get in every morning, you might give some thought to being an entrepreneur. . . perhaps starting a small business at home in a field you enjoy.

Or you can use your time to call in on the net every night and trade jibes with friends. I did that for a couple years, so I know it's fun and kinda addicting. It's like standing around the corner with your gang . . . and about as productive. Bill and Olga, Homer, Leo and I had a great time on 75m.

Well, in truth I did a little more than chitchat on the net. I also was building some nice VHF gear and working 2m DX from New England mountaintops. I ran up a pretty good DX score too. . . won the ARRL Sweepstakes for my section. . . all while going to college, running a sandwich and laundry business, starting the campus broadcasting system (WRPI) and stuff like that, plus a romance which will be a feature chapter in my memoirs.

Even if you're retired you've still got a few years to start and run your own business. You'll be having so much fun you won't have time to die. And you'll be making so much money you won't even gripe about the *73* subscription price.

I'm going to build a national sales force to rep a bunch of music magazines and several hundred independent record companies, so if you have the time and a whole lot of interest let me know. I'm going to give hams first crack at what could turn out to be a pretty good business. If you think this is for you, I can send you the gory details.

Making Your Club Work

The only real organizations in our hobby are our local radio clubs, so it's important that we make them do as much as possible to help our hobby survive. . . perhaps even grow. And that means making meetings fun and recruiting potential new hams.

Let's mull over this fun thing first. Having been to more ham club meetings than you, by a wide margin, let me assure you that pitifully few of them qualify as candidates for fun evenings . . . except of course, ahem, if I'm on the program. And that's fun for me, even if it isn't for you.

If you're the president of a radio club it's highly unlikely you're going to be reading this. Most clubs seem to be firmly in the grips of old fogies. . . who really hate my editorials. They disagree with what little of them they can understand. And, having had their sense of humor atrophy from disuse, they try to take me seriously. . . which isn't going to get anyone anywhere.

Alas, they bring their old-fogy grumpiness to meetings to share with any ham newcomers who have the guts to chance trying the club. Many club meetings, having been taken over by these fogies, are exercises in group grumps. They bitch about the lousy bands. They gripe about no-coders. They kvetch about how expensive rigs are these days. . . somehow forgetting that their old nickel ice cream cones are now $1.62, with tax. Their diet tends more to bran and prune juice, so maybe they haven't bought a cone lately.

If the shoe doesn't fit with your club, be thankful. From my personal experience...and from hundreds of recent reader letters. . . I'm not exaggerating.

If you want to build up attendance at your club you have to make the meetings fun. This means making sure that your members keep an eye out for any newcomers and make a special effort to shake hands and rag-chew. Ever been rushed by a fraternity? They have a team waiting at the door which shakes your hand and guides you into the clubroom and gets you started talking.

The executive committee should take care of 90% of the club business so you can keep the business part of the meeting mercifully short. The common denominator is amateur radio, so get right on to talking about that. What's doing on 6m? How's 10m doing? Anyone work some good DX on 75 or 160? What's happening with packet? ATV? SSTV? How about high-speed CW?

Has anyone bought any new gear they can talk about? Anyone built something they've brought in to show? Is there a hamfest within driving distance where you can organize a convoy? How about a group flight to Dayton next year, complete with a group picture by the big hamfest sign?

Any contests coming up where the club can participate? Tried fox hunting on Sundays yet? How about a club video showing what interesting things your members are doing? Are your DXers all connected via a repeater so they won't miss any rare ones?

Have you any tech sessions before

Continued on page 87

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

ARRL Petition for 216-220 MHz

The ARRL has filed a petition with the FCC to request an Amateur Radio Service secondary allocation at 216-220 MHz. The massive, half-inch proposal weighs a full pound. Comprised of four sections and three exhibits, it is well-documented and impressive. The ARRL states that "This allocation would provide re-accommodation for those present and future wideband data intercity links and other point-to-point fixed amateur stations. . . displaced [last August] from the 220-222 MHz band as a result of the reallocation of that segment in Docket 87-14."

The League believes that amateurs can peacefully co-exist with present and future users of the band. The Commission may also have this belief, since it was they who initially suggested this approach. The 216-220 MHz band is currently allocated to various mobile and fixed services. The ARRL petition asks that Part 97.303(e) be changed to read: ". . . the segment 216-220 MHz shall be used only for point-to-point amateur fixed operation. No amateur station operating in that segment shall cause harmful interference to, nor is protected from interference from, maritime mobile stations, fixed stations, or other mobile licensees operating in the band. Nor shall harmful interference to broadcast television reception be created from operating in that band. Prior to commencement of amateur operation in that band, amateur stations are cautioned to contact a database administrator for the Amateur Radio Service for frequency recommendations in order to avoid interference to licensees of other services. The Licensee of the amateur station must make all necessary adjustments, including termination of all transmissions, if harmful interference is caused."

Part 97.313(d) would also be changed to read: "In the 216-220 MHz segment of the 1.25m band, no station may transmit with a transmitter power exceeding 50W PEP." TNX *W5YI Report, Vol. 13, Issue #13.*

PRB-1 Validity Questioned

A federal appeals court has ruled that ham radio operators are not entitled to absolute protection by FCC statutes enacted to give them special rights to have antennas. In doing so, the court has brought the constitutionality of PRB-1 into question. On June 19, 1991, the 9th Circuit Court of Appeals for Northern California denied a claim by a Burlingame, California resident, Vernon Howard W6ERS, who argued that federal law guaranteed his right to build a 51-foot antenna tower in his back yard, and his right to use it freely to communicate with fellow hams worldwide. The three-judge appeals panel rejected Howard's contention that the city violated his free speech rights.

According to Howard, his initial application for a variance was turned down in 1987 after what he feels was an unfair hearing by the Burlingame planning board. W6ERS said that forced him to take the city to federal district court. The judge ruled in his favor, based on PRB-1 guarantees, so Howard installed his tower and antenna, then went about trying to recover the $25,000 he had spent in court costs and legal fees. When this failed, W6ERS took legal action on his demand for reimbursement. It appears that this action resulted in the city deciding to let the appeals court make a final determination based solely on the merits of the issues.

The court ruled that FCC regulations entitle ham radio operators only to a "fair consideration by city officials" of their applications to build antennas. Cities and municipalities are still required to make a "reasonable effort consistent with local zoning goals to accommodate the projects," as mandated by PRB-1, but at the same time stating that esthetics can be considered in making a determination of whether to allow the erection of such structures.

The decision upholds the earlier ruling of a federal district judge in San Francisco who validated Burlingame's authority to regulate the heights of back yard antennas over 25 feet high, and cites the 4th Circuit U.S. Court of Appeals decision in Williams vs City of Columbia, South Carolina, where the court said the city had complied with PRB-1 by allowing a 17-foot high antenna. These decisions questioning the constitutionality of PRB-1 are at odds with other federal appeals courts which have agreed with the FCC and the amateur radio community on PRB-1's constitutionality.

Eventually, PRB-1's validity will probably have to be determined by the United States Supreme Court. According to one attorney, the Howard vs Burlingame findings are damaging for ham radio. The case will appear as a precedent-setting decision of the court that is just one level below the Supreme Court. It will also be published in the *Federal Register,* which is kept in virtually every law library in the country. Every city attorney who reads it will learn that a city has the legal right to flatly turn down any antenna permit request despite PRB-1. TNX *Westlink Report, Number 605.*

Haas Convicted

Last June, James A. Haas, 39, of Athens, Ohio, pleaded guilty in a U.S. District Court trial in Alexandria, Virginia, to federal charges of broadcasting a false officer-in-distress call and using a credit card without authorization to buy $1,000 in radio equipment. Haas, adviser to the ham radio club at the high school where he has taught physical education for 17 years, could face up to 15 years in prison. Currently out on $100,000 bail, he will be sentenced on August 30, 1991.

In April 1991, FBI agents caught Haas in his van, transmitting a false officer-in-distress call on a Prince William County police radio channel. He was parked in a Sterling, Virginia, neighborhood where he was staying with friends so that he could attend a hamfest in Baltimore. In his plea agreement, stating that he would cooperate with federal authorities, he admitted making a similar call to the Prince William County department in July 1990.

The FBI had been on Haas' trail since February in connection with similar broadcasts in Kentucky and Ohio. They suspected him of making dozens of fake distress calls, many of which resulted in massive searches by police agencies. One search that involved 15 agencies and the use of helicopters lasted 10 hours. According to police authorities, Haas could also face charges for fake calls made in Kentucky and Ohio as well as in Virginia. TNX *to Steve Boch at Universal Radio, in Reynoldsburg, Ohio, for the newspaper clipping, and Bob Blinn for the story on MCImail.*

Amateur Radio Spectrum

The Amateur Radio Service has only 2/10 of 1% of the total amount of spectrum from 0-30 GHz allocated for its exclusive use. Amateur radio is sometimes described as having generous spectrum allocations. For example, on the 220-222 MHz re-allocation, the FCC stated repeatedly that amateurs have substantial amounts of other spectrum in which to operate. A chart used by the ARRL, however, clearly shows that of the less than 5% of spectrum allocated to it, the Amateur Radio Service shares 4.5% with other services, and is subject to their interference. TNX *W5YI Report, Vol. 13, Issue #14.*

WWV Solar Report

The WWV Solar report is now updated at 2118 UTC, rather than at 1818 UTC. This is because the solar flux is currently measured at a British Columbia solar station, rather than from Ottawa. The K index will continue to be updated every three hours, as at present.

Speaking of solar activity: Those strange whistles on the low bands last June were examples of "Type II" radio sweeps generated by solar flares from sunspots in a region designated as 6659, an area at least 50 times the size of the earth. This gave DXers a major opportunity to experience the effects of major flares on radio propagation.

The onset of the flare is marked by a SID

(Sudden Ionospheric Disturbance), followed seconds later by the disappearance of HF signals from the sunlit side of the earth. About 15–20 minutes after that, a slow, decreasing whistle moves through the bands. Soon after the flare dies, the bands recover, but only to deteriorate 30–48 hours later, when the slower-moving charged particles from the sun disrupt the geomagnetic field.

Large solar flares can also produce magnetic waves that compress the earth's geomagnetic field and send power surges down electrical transmission lines and pipelines. TNX "The DX Bulletin," Issue 593, and *Westlink Report, Number 604*.

RSGB Awards Astronaut

The Radio Society of Great Britain presented UK Astronaut Helen Sharman (GB1MIR/UA) with a commemorative copy of its new video titled "Amateur Radio—The Hobby of the Space Age," in recognition of her becoming the first citizen of the United Kingdom to operate an amateur radio station from earth orbit. Last May, Sharman spent several days on the Soviet *Mir* space station and operated its amateur radio installation, talking to students in schools throughout Great Britain. Musa Manarov U2MIR was her host. TNX *Westlink Report, Number 605.*

Balloon Launch

The Dayton Amateur Radio Association (DARA) sponsored helium high altitude amateur radio experiment was successfully launched last June 29 at 9:20 a.m. The balloon attained a maximum altitude of 86,000 feet (over 16 miles) and was recovered three minutes after it landed in Beavercreek by the RDF crew headed by Paul Bohrer W9DUU.

During the 2 1/2 hour flight, the 20 meter beacon was heard throughout the world. Dara is still receiving QSL cards. The 2 meter beacon was heard, and the ATV beacon seen, out to about 450 miles from Dayton. Returns have been received from New York, Pennsylvania, Connecticut, South Carolina, Iowa, Michigan, and Kentucky, as well as Ohio.

The event was organized by Dave AH2AR, with help from many hams, including N8NEU, KB8EMD, W8LLW, N8JAF, W8ILC, W8RVH, K8GCS, and WB8ELK.

Bill Brown WB8ELK, editor of *73 Magazine,* added a 35mm camera to the balloon payload and some great photos were taken up to 60,000 feet before the camera froze.

Brown is scheduled to be the guest speaker at the first DARA meeting in October. His ATV presentation will cover high altitude unmanned balloon launches and amateur radio experiments. TNX Dave AH2AR via "RF-Carrier," Vol. 35, No. 11. *[See this month's "ATV" column for the complete story.]*

NiMH Batteries

A new battery technology may soon replace NiCds. Nickel-metal-hydride, or NiMH batteries, have 80–100% more electrical storage capacity by weight. These batteries have recently passed a testing milestone of 20,000 charge/discharge cycles at 30% depth of discharge. This could be a significant advantage for small satellites. A quantity of the new batteries is being obtained from Ovonic Battery Company of Troy, Michigan, by builders of the SEDSAT-1 amateur satellite.

The satellite will use a current-regulated power system with the voltage tentatively set at 30 volts. There will be 40 cells aranged as two batteries, giving 30 volts DC at a full charge of 100 amp/hours per battery. A prototype of the power system will be constructed at the Marshall Space Flight Center, Electronics Branch, by NASA personnel and by University of Alabama Students for the Exploration and Development of Space (SEDS), an AMSAT-NA Member Society.

In conjunction with the NiMH batteries, the 14″ x 14″ x 12″ SEDSAT-1 will use high efficiency (about 26%) AlGaAs/CIS tandem solar cells donated by Boeing Defense and Space Company, Renton, Washington.

Volunteers of the new AMSAT-NA Spacecraft Lab in Detroit, in consultation with other AMSAT-NA engineers and technicians, plan to construct the OSCAR communications package for the project. TNX "Oscar Satellite Report," Number 224.

UoSAT-F Launched in July

UoSAT-F, also known as OSCAR-22, provides store-and-forward communications for SatelLife, an international nonprofit network for health professionals. Initially, five African medical schools will use HealthNet to receive e-mail and up-to-date medical literature. When not serving HealthNet on commercial frequencies, UO-22 will QSY to amateur satellite channels, sending AX.25 data at 9600 bps.

The amateur uplink is on 2 meters, the downlink on 70cm. Stations using UO-14 will be able to receive UO-22 with the same software and hardware. Telemetry, status messages, and files are transmitted in the same pattern and format.

UO-22's role will be similar to that of UO-9, -11, and WEBERSAT. Instead of providing two-way communications, it will transmit experimental data and telemetry. It carries a CCD camera with a wide-angle lens, and will broadcast images using the PACSAT Protocol. TNX John Magliacane, MCImail "SpaceNews" for informing us of the launch, and *Westlink Report, No. 604.* Also, for more details on SatelLife, which is overseen by a distinguished board of scientists and physicians, see "QRX" in the June 1990 issue of *73*, or call Sharyn Cooper at (617) 661-6468.

11 Meter Soporific

A 27 MHz instrument appears to stimulate sleep-inducing areas of the brain, says Boris Pasche of Brigham and Women's Hospital in Boston. Co-author of a study led by Milton K. Erman of the Scripps Clinic and Research Foundation in La Jolla, California, Pasche and his colleagues are now investigating its effect on melatonin, a hormone secreted by the pineal glad in sync with the sleep-wake cycle.

Insomniacs using the device fell asleep 52 minutes faster than control subjects using inactive devices, and slept 1.5 hours longer. Although the Environmental Protection Agency reported last year that steady, weak electromagnetic fields constitute "a possible but not proven cause of cancer," Pasche says he and his colleagues do not believe this device has any adverse effects because it does not emit a steady magnetic field. TNX Miles Abernathy N5KOB for this excerpt from *Science News*, July 6, 1991.

73 BBS

The 73 BBS crashed recently (it literally fell off of the table), but it is now up and running. Since we weren't overly thrilled with the old BBS software, we politely swept the pieces under the table and installed a new BBS package called OPUS. There are separate sections for messages or files under each SIG (Special Interest Group). This should make it easier to find programs and files without having to wade through dozens of messages (as in the old software). Most of the programs and files listed in past issues of *73* are available in the "File" section of the *73 Magazine* area (it may take awhile to recover them all). Use the "Messages" section to send bulletins or leave messages. Please let us know how you like the new BBS; just leave our SYSOP Joyce a message when you log off. The BBS phone number is (603) 525-4438.

N4RVE Discovered

High tech nomad Steve Roberts N4RVE and his new computer/ham radio/gadget-laden bicycle, the Behemoth, appeared in the July issue of *Discover* magazine. In 1988–89, Steve wrote a series of articles on hamming and computing across America on his solar-powered Winnebiko. Last year, he built the Behemoth, which stands for Big Electronic Human Energized Machine. TNX *Discover* and *W5YI*.

Number 3 on your Feedback card

LETTERS

From the Hamshack

David KB5LAM/4 The May '91 issue was the best yet. I'm pulling together everything I need to build 'em all. I'm on VHF packet via KK4CQ, but not too many want to QSO. Lots of "busy" messages. There are a *bunch* of hams around Pensacola. There's Sam N4SAR, who has a school program going . . . he's had his 100th licensee in the many years he's been at this.

I've finally had a chance to read the last five years of *73*, *QST*, and *CQ*. I looked for good construction articles which were interesting, but not too daunting. I marked 'em with "Post-Its." *QST* had good stuff once a quarter or so, and they asked for money a lot. *CQ* did okay with antennas, in between endless contest scores and announcements. *73* was the clear winner by a couple pads of notes. You've also gotten better. The last two years have given more encouragement and better gadgets I believe I can do.

You're a good man, Wayne Green. I've learned much from you and those you've gotten to write for you; and not just about radio. Say, if you learn of someone needing a *good* manufacturing/quality engineer, let me know. I love to build things *right*!

Tell Sam I'll believe he's making Novices when he starts sending pictures for us to publish. . . . Wayne

Rob ND1V Hello from a fellow submariner. Enjoyed your *USS Drum* (SSN) trip, wished I could have met you. I'm an ETC/SS and an Electronic Surveillance Measures (ESM) tech. I used to be on the *USS Silversides* (SSN-679). The ET school would greatly disappoint you these days. They now teach these guys to troubleshoot to the "board" level and not much deeper. A generation of black-box techs. Oh, well, it saves the taxpayers money, so they say.

That's bad news! I wonder if they can carry enough spare boards to fix anything that goes wrong? The next step is to have the boards self-checking so we can save taxpayers the whole ET school cost. With two of each board in every unit, a future ET would only have to replace the bum boards as they burn out. The equipment would keep right on running. . . Wayne

Thomas Wyckoff, Kenilworth NJ I picked up a copy of *73 Today*, and the only thing I didn't like about it was that the back page was too close to the front page.

I passed the tests for the no-code Tech last week, and have been listening to the bitching on 2 meters while I wait for my license to arrive. I wonder how these old geezers would react if they were told that they had to pass a test on IBM 360 assembler before they would be allowed to connect a PC to their rigs and get into packet radio.

One of the things the FCC was created for is to balance the allocation of the frequency spectrum with the needs of the users. Since we are only one-quarter of one percent of the population, I can see us losing a lot of frequencies in the future unless we greatly multiply in numbers, and do it quickly. Us no-code Techs may well be the salvation of amateur radio, not its downfall. Sooner or later some politician will stumble on the fact that 99.95% of the population is limited to CB or cellular phones, and make an issue out of it. When that happens, God help amateur radio. Cellular phones are nice, but every time I look at mine, I am reminded of a TV game show from about 30 years ago, a show called "Dollar a Second."

Doug Pine NH6ZA, Makawao HI I was re-licensed last month after almost 15 years of inactivity. At age 13 I was an active General class ham (WA6CKK) and proud of it. I even had a subscription to your magazine and was a member of the ARRL. Before too long, though, high school, surfing, and girls turned my head. I wanted to remain an active ham, but no one I knew among my ham friends wanted to talk about anything but electronics, repeaters, and transistors. I always thought there was more to the hobby than that, and for a while I knew a few people on 40 meters who agreed with me. We talked about surfing, music, politics, religion, drugs, women, and anything else we felt like. We weren't using foul language or improper procedures. We were within the bands, and we identified legally, and anyone was welcome. We were exercising our minds and our hobby at the same time. It was FUN! We called ourselves the "Free Thinkers' Net," and had a grand old time of it. After a few months, we began getting harassed and even jammed by "proper" hams who felt it was their duty to "keep us in line," as one OM put it. I called it quits at 17, sold my station, bought a surfboard, and moved to Hawaii.

Now I'm 30, married with a kid on the way, settling down, all that scary stuff. The radio bug bit again about a year ago. This spring I got out the study guide and passed my General class exam. I haven't gotten on the air yet for lack of a rig, but I will soon. I picked up the June issue of *73* and read it. Lots of new things; let's see. . .this packet stuff looks interesting, satellites are happening, the latest rigs are amazing. I read your editorial. Nice satire about the QSO machine, but the point it made caught my attention the most. The same stuff I tried to do 15 years ago—get beyond the standard QSO: name, QTH, rig, pse QSL, 73 and good-bye. Communicating. Learning about human beings on the other side of the world firsthand. I'm hoping to be able to do just that when I get back on the air. I'm not at all surprised to read that most hams still don't communicate beyond the most basic level.

I wasn't surprised to read about all the furor over the no-code Tech. Old traditions die hard, don't they? Knowing how to send 30 wpm doesn't make me a good operator; my desire to be one leads me in that direction. I don't know jack-diddly about theory. Does that make me an unwanted member of this fraternity? I just love the magic of radio, period.

I took my test with a room full of people going for the no-code. They were sincere and excited about their entry into this hobby, and almost without exception planned to continue onwards and upwards. More power to 'em, I say.

Doug, Max Planck (the physicist who formulated the quantum theory) said it this way: "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it." Or, as my grandmother used to say, "A man convinced against his will is of the same opinion still." So Doug, let's keep watching the Silent Keys list as the CW fanatics are gradually all listed and replaced by newcomers. . . . Wayne

Rudy Ault N2JZK, Troy NY My latest issue of *73* arrived today. As usual, I was reading "Never Say Die" before the plastic wrapper hit the floor. The things I found irked me into writing this letter at the odd hour of two a.m.

I live in the Albany-Troy-Schenectady area of New York. There are some things going on over here that you may find out of the ordinary for amateur radio these days. In your last issue you mentioned passing through Troy and not being able to find anyone on a repeater. You must not have tried the 147.27/.87 machine on the Ch. 13 tower at Bald Mt. There is a group of people there who don't fit into the amateur mold. We joke around, we discuss everything from the Civil War to astronomy, we are HAMS. You would fit in here, Wayne. Why not try to call us one night? This machine has a tremendous range.

Bill Eddy NY2U is the president of the Troy Amateur Radio Association. He was important in founding the Capitol District Amateur Radio Council, CDARC, which co-ordinates the efforts of the member clubs in this area. They even sponsor a twice-weekly bulletin broadcast on all member repeaters. Steve WA3RKB keeps us informed of events, news, and VE exams, all via 2 meter repeaters.

The Rennsselaer County RACES club is making great strides in interlinking its three repeaters to give full 2m coverage to the county. Lance WS2B is doing the hookups (with a small break to graduate from high school). Lance, an Eagle Scout and the repeater manager for the county RACES, is 17-years-old.

Since I got my first call in 1988 (KB2FVR), there has been an average of one VE session per month in this area. I upgraded to Technician and drug my poor wife into the hobby as she kicked and screamed. Her call is KB2LGA. She is also a Technician. My brother-in-law is now waiting for his new Technician ticket. He cannot do code, Wayne, but he has written several computer programs that will. My brother Ricky passed his Novice written, and is planning on getting his Technician soon. He will be quite an asset to the Frederick County, Maryland, area.

Some of us *are* trying, Wayne. Some of us do dream, and hope, and work to better the hobby. When you get in town again, give a call to some of our clubs . . we are in the Yellow Pages!!!

William A. Ward N4BLR, Atlanta GA I am a black ham operator and proud of it. For years I have read your "Never Say Die" editorials devoutly, and have always enjoyed them. After reading what K9RGV had to say about the contributions of black hams, I agree with him, but I am personally fed up to here with the notion of having to have a "set aside program" for black hams. What will be next? A set-aside page for gays, Native Americans, etc.?

If you want people to know about you, the answer is PR and plenty of it. The percentage of blacks in ham radio is less than 1%. Here in Atlanta we have between 75 to 100 black hams. We have what is called the "corner" where quite a few black hams hang around. Some never leave these frequencies because they might have to talk to someone other than a black. It has always seemed to me that there's an underlying fear out there to talk to anyone unless they're black.

Having been born in the South, I know that some people's attitudes haven't changed much, even on the ham bands. I don't expect these bigots to change. From the time I received my ticket, I've operated all of the bands that I was licensed for. I've never been afraid to talk to anyone who would talk to me. I've met and had quite a few friends on 75 meters, especially around the Georgia SSB net frequency of 3.975, and I couldn't have met a nicer bunch of fellows.

Wayne, I've talked with some of the older black hams, and they have told of the hell they caught in the '50s, '60s, and '70s, and I can understand their frustrations and attitudes. However, we are living in the '90s, so let's act like we're living in the '90s. I am not going to shut myself off from the rest of the ham community.

What have I done in ham radio? I was instrumental in forming the Metro Atlanta Amateur Radio Society. I started a 40 Meters Traders Net three years ago, which has grown steadily. Incidentally, a few people said I couldn't get it to work because I'm black; what do they know? I reactivated an old net, the Fourth District Amateur Radio Society, that had quit operating. This net is geared towards sharing your technical expertise with others. I've appeared on a talk show to explain what ham radio is, and how one can get into it. I've built quite a few projects out of *73* over the past years, and I've enjoyed reading *73*. Most of my knowledge of electronics is self-taught by reading and experimenting.

Finally, I want to agree with you on boring QSOs. I'm really tired of conversations that are Boring, Boring, Boring. There must be a million things a person can talk about, but most never do. Does anyone ever watch any National Geographic Specials or C-Span or read any books? Are there any builders out there working on a new design? Every now and then I run across someone doing just that, and it's a pleasure to talk to him.

C.R. Phillips N3HTZ, Langhorne PA The president of a local repeater came on and chastised two new hams and myself for having a "CB rag-chew" on his club's repeater. What I want to know is what constitutes a CB rag-chew? I will not, and many of my friends agree, put my personality aside to talk on ham radio. I do not curse or talk about taboo things on ham radio, but I try to make interesting conversation. What an example the president of this local repeater club is setting towards new hams, and hams who may be traveling in the area. Keep up the good work, Wayne.

73 Review

by David Cassidy N1GPH

The Outbacker All-Band HF Mobile Antenna

Results of a 12-month road test.

Outbacker Antenna Sales
330 Cedar Glen Circle
Chattanooga TN 37412
Price Class: 6 ft., $259; 4 ft., $219; 6 ft., 2-piece, $289.
Tel. (615) 899-3390.

Photo A. The Outbacker.

A little over a year ago, a new mobile antenna became available to the ham radio market. Called the Outbacker in honor of its Australian origins, this rugged yet attractive antenna soon began to show up on the bands and to receive some nice reviews in amateur radio publications.

For the last 12 months, I have been testing the standard one-piece, 6-foot, 8-band Outbacker. It has gone through a New England winter, has been installed on three different automobiles, and has been used as a base antenna at two different locations.

A Little History

The Outbacker antenna, as its name suggests, is a product of the Australian Outback. Terlin Aerials of Australia has produced this antenna for 15 years, serving customers who need a no-nonsense mobile antenna that can survive the extreme conditions of the harsh Australian Outback. The Outback is a vast area of the Australian continent where ranches are measured in hundreds of miles. There is no telephone service to most of this area, so those who live and work there rely on HF and VHF radio for just about all of their communications. When the nearest medical facility is hours away by air, even a compound fracture can turn into a life-threatening emergency. To people of the Outback, the performance of their radio gear is literally a life-and-death matter.

The man who brought the Outbacker to the U.S. market is Don Arnold WD4FSY. Don is a professional photographer who travels the world. When his profession brought him to the Outback of northern Australia, he noticed that every Jeep, Land Rover and truck had the same thing—an epoxy resin coated multiband antenna. Being a ham, he checked into this unusual looking aerial. What he discovered is that Terlin Aerials manufactures these HF antennas in a variety of multi-band configurations—for business, marine. Don received a ham band version of the Outbacker, and was so impressed that he arranged to have a few more sent as prototypes. Thus was born Outbacker Antenna Sales of Chattanooga, Tennessee.

The first time I met Don face-to-face was at the Southwestern Convention in San Diego. Since then I've seen him at every major hamfest, usually with the same set-up. He gets a booth by the door, runs some coax to the outside, and sets up one of his Outbackers (usually hidden in a potted plant or some other form of shrubbery). Don is also fond of demonstrating the strength and durability of his product by bending the antenna almost fully back on itself, inviting passers-by to slam the antenna against the floor, or by pounding the living daylights out of the antenna with a hammer. I've seen this demonstration dozens of times now, and I've yet to see an Outbacker damaged by this rough treatment.

The Antenna

The Outbacker is a hollow fiberglass pole covered with a black epoxy resin and a final protective coating (if you're willing to wait several weeks, you can order an Outbacker direct from Outbacker Antenna Sales in almost any color you want). There's a 6-foot version, a 4-foot version, and a 2-piece 6-footer.

The main antenna is a helical copper coil. Each antenna is handmade by Terlin Aeriels of Australia. After the antenna is manufactured, each is hand-tuned for accuracy and field tested for each band of operation.

The unique way the Outbacker provides all-band performance is something they call the "wander lead." The wander lead is coiled around the outside of the antenna, and one end is inserted via a banana plug into a jack near the base of the antenna. The antenna has a series of silver-coated brass jacks recessed into the fiberglass, each jack corresponding to a different band of operation. To change bands, you simply wind the wander lead around the antenna and insert the plug into the appropriate jack.

There is also a short whip at the top, which allows for fine tuning the SWR. The whip has a mark scored on the side. Setting the whip at this level gives you a good SWR from 40–10 meters. If you want to operate 75 meters or the high end of 10 meters, it's a good idea to put an SWR meter in line and reset the whip.

You can purchase a heavy duty spring mount from your Outbacker dealer. This is one of the sturdiest mobile mounts I have ever seen, and if you have the type of vehicle that can accommodate this, it would probably survive long after the vehicle crumbled to dust. For those of us who don't want to permanently alter our rubber-bumpered cars, Outbacker suggests the 4-foot Outbacker Jr. model with a Diamond K400-3/8, 24 lip mount. This grips your trunk or hatchback with only a couple of puckers on the internal side (which helps ground the mount to the car body) and holds up fine to highway speeds. Mounting the antenna at trunk or hatchback level also gets the majority of the radiating surface above the car body. This arrangement is only for the 4-foot Outbacker, and you need to put a heavy duty spring between the mount and the antenna.

The One-Year Road Test

There is a right way to install a mobile antenna and a wrong way. Not wanting to wait to test out the Outbacker, I immediately ran down to my local Radio Shack and purchased one of those bumper mounts with the little clip and chain arrangements. These used to work just dandy on older cars with metal bumpers, but I quickly found out that my old rust-bucket was equipped with those darn rubber bumpers. Undaunted, I found a place to clip the hold-down chains, braced the whole thing with a bungee chord so the 6-foot Outbacker wouldn't sway in the breeze, ran the coax to the front of the car, hooked up my HF rig and away I drove. (In case any of you are wondering, this is the wrong way to install a mobile antenna.)

My first contact was on 20 meters with a ham in Manchester, England. He was very cooperative in answering questions about my signal and reported a strong 5 x 7. Not bad for 100 watts, a stock hand mike and an antenna that, despite the bungee cord arrangement, was tilting in the breeze at about a 30 degree angle! After clearing with the chap in Great Britain, a ham in Florida called to report that he was receiving me at about the same 5 x 7.

For the next few weeks I checked into WB2JKJ's Classroom Net on 40 meters (7.238 MHz at 7 a.m. This is a great rag-chew net for

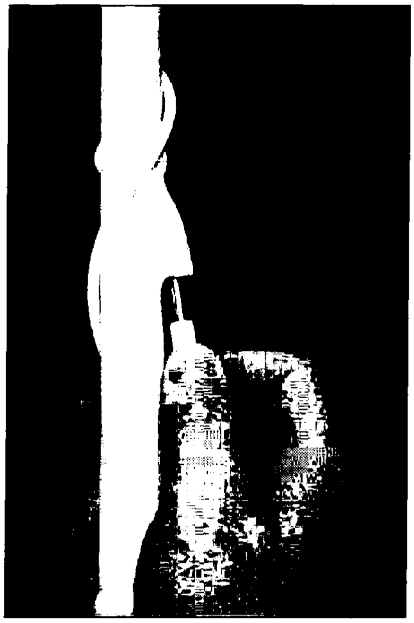


Photo B. To change bands just wrap the "wander lead" around the antenna and insert the jack into the appropriate plug.

morning commuters. It is operated by Joe Fairclough—one of the nicest guys you'll ever meet in ham radio—out of The Radio Club of Junior High School 22 in New York City.). The net was very helpful in establishing the omnidirectional performance of the antenna. Consistent reports from upstate New York, Virginia and Canada proved the Outbacker was putting out a nice signal to all points on the compass.

Since I knew my car was destined for the junk pile, I didn't bother with a more permanent mounting arrangement. For using the 6-foot Outbacker, I would suggest either side-mounting the antenna (which requires drilling into the car body) or some kind of trailer hitch arrangement. Both of these options can be done using the heavy-duty spring mount mentioned earlier.

The Outbacker as a Base Antenna

Not too long ago I was living in a one-bedroom apartment. I tried all kinds of schemes to get an HF signal out with indoor or invisible outdoor antennas. Though I now have plenty of space for outside wires, I was anxious to test the Outbacker as an apartment/condo antenna.

A quick trip to the hardware store or Radio Shack should provide you with all the ideas and materials for fabricating a window mount for the antenna (I used the bumper mount mentioned earlier, and a few clamps and L-brackets from the hardware store). Open the window, mount the antenna, run the coax, and you're on the air. From my ground floor location, I was not setting the bands on fire, but I made plenty of contacts—especially on 10 and 40 meters. Changing bands was a matter of opening the window and reaching out to change the wander lead. I figured this was a small price to pay for 80–10 meter capabilities. When I was done operating for the evening, I simply brought the antenna in.

The secret of operating with this type of arrangement is the ground connection. The antenna mount should be wired to the best possible ground available. Some of my QSOs reported a 3–5 dB loss of signal when I disconnected my cold water pipe ground lead. If a ground is not available (or in addition to a ground), a 1/4-wave counterpoise wire can be attached for each band of operation (using ribbon cable for this will keep things neat). Either throw the counterpoise wires out the window or run them along the wall of your shack.

An alternative for those who have first floor apartments is to park your car near your shack, leave the antenna mounted on your vehicle, and run the coax into your shack window.

Don't expect to break into any 20 meter pileups with this arrangement, but you'll still have plenty of signal for normal rag-chewing. I think the Outbacker is a great choice for the apartment/condo ham.

Further Road Work

When I traded in the old clunker for a new compact car, I was leery of mounting any antennas on

Photo C. The adjustable tip allows for fine-tuning SWR.

that nice shiny paint. When the new car went back to the dealership for service, I was provided a loaner vehicle. The desire to check in with some friends on 80 meters during a late-night/early-morning solo drive across New England provided the perfect opportunity to test the Outbacker in another configuration.

I mounted a 4-foot Outbacker Jr. to the car with a Diamond trunk mount (make sure you use a heavy duty spring and NEVER attempt this with the 6-foot Outbacker), ran the coax to the front seat, and I was on the air. Total install time: five minutes.

The performance of the 4-foot Outbacker Jr. is surprisingly close to the performance of the full-size version. I didn't have any trouble making local contacts on 40 meters, and I was able to key up the Virgin Islands 10 meter repeater with only 20 watts. That evening, I QSOed with my friends on 80 meters for over two hours. I usually received them at the same level I do from my home shack—10 dB over S-9. When I first joined the roundtable, they were shocked to discover that I was operating mobile. Solid S-9+ signals were reported throughout my journey.

For those who travel and use rental cars a lot, an Outbacker Jr., a Diamond trunk mount and a small HF rig would be a perfect travel setup. The 6-foot Outbacker is offered in a two-piece model, but the trunk mount won't handle this antenna. If Outbacker would come out with a four foot, two-piece version, the entire set-up could fit in a carry-on bag.

Final Thoughts

To put it bluntly, I am very impressed with the Outbacker. It is easily the most attractive multiband HF antenna available. The black epoxy can be buffed to like-new condition with auto wax, so even after a New England winter (where salt and sand coat the roads for four months), the antenna looks like it just came out of the box. If you're willing to wait, you can even order an antenna that matches your car. (Outbacker offers other special models, including HF marine. In fact, you can special order just about any combination of special frequencies.)

The Outbacker is hand-made, and the quality is evident. Plugs and jacks are silver coated brass. The wander lead is heavy enough to stand up to weather, but light enough to easily wrap around the antenna. I can't imagine how anyone could damage this antenna, even under extreme conditions. The final coating applied over the epoxy resin will sometimes peel a little around the recessed jacks, but this is barely noticeable, and in no way affects the strength or performance of the antenna.

I found the on-the-air performance of the Outbacker equal to any other mobile antenna I have used, and the wander-lead system of band switching very convenient—much easier than carrying around a trunk full of loading coils.

When you take great mobile multi-band performance and add the easy portable and apartment/condo applications, I think the Outbacker is a great choice for a variety of HF antenna uses. 73

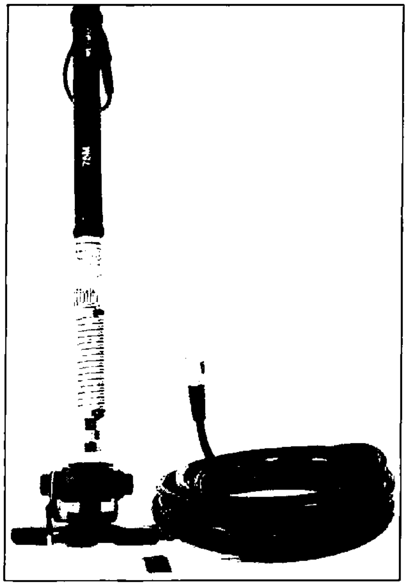


Photo D. The Diamond K-400 mount. Outbacker recommends this sturdy trunk/hatchback mount for the 4-foot Outbacker Jr.

The Square Pancake Antenna

The indoor marvel.

by Ken M. Doolittle W2SMR

Apartment dwellers, ATTENTION!! Here is a limited-space, simple, and inexpensive inside antenna that works. I've made hundreds of complete QSOs with this little 20-inch square that hangs from the ceiling over my rig. I can reach up and tune it in a few seconds. Frequency coverage is 80, 40, 30, and 20 meters.

For comparison, I often switch to my 40 meter center-fed Zepp. With 1–50 watts into the antenna, signal strength reports vary from 0–5 S-units below the Zepp. Not bad for an inside antenna only 10 feet above the ground.

There's nothing magical about this antenna. The basic design has existed in various forms for many years, but it has seen little use for transmitting because of high losses. However, in spite of losses, you will be amazed at the results you can get. Twenty meters, for example, has yielded many DX stations. On 3537 kHz, I worked YU7WW in Belgrade.

Originally, I built this small antenna for local schedules on 80 meter CW, using less than 1 watt of power. Then, one night in November 1988, I was surprised to hear a Connecticut station calling me. Subsequently, I found that many distant stations could be worked on 1 watt. This led me to redesign the antenna, using thicker wire, and adjusting it to cover the other bands.

One time I was using this antenna in a three-way QSO on 30 meters. One of the stations became really hostile when I described my antenna, and did everything but call me a liar. He threatened to come to my home from Massachusetts and see my antenna himself. I told him to come along, but he finally got so upset he quit talking. It was one of the strangest things!

Construction

See Figure 1 for details. The plywood bottom piece is glued and nailed to the bottom of the vertical, 30-inch-long cross-piece. The vertical piece is 1 inch longer on the bottom to space it away from the plywood bottom piece. Attach the 29-inch cross boom to the vertical support piece. Starting from the edge of each support piece, cut seven ¼-inch deep grooves spaced about ¾-inch apart (see Figure 2). Angle the grooves so that the bottom of each groove is closer to the center point of the antenna. That way when the wire is wound around the support pieces, the grooves will keep the loop tight.

Drill a ⅛-inch hole ¼ of an inch above and below the seven grooves on the bottom portion of the loop. These holes are used to anchor the beginning and end of the wire loop. Cut a 37.5-foot length of #16 copper wire and loop one end through the bottom hole and run it down to the bottom attachment plate. Now loop the wire around through the grooves until you have 7 full turns in place. Run the end of the loop wire through the top support hole on the bottom support leg and tie it in place. A small wire loop can be placed through a hole in the very top piece of the antenna so that you can hang the antenna from the ceiling.

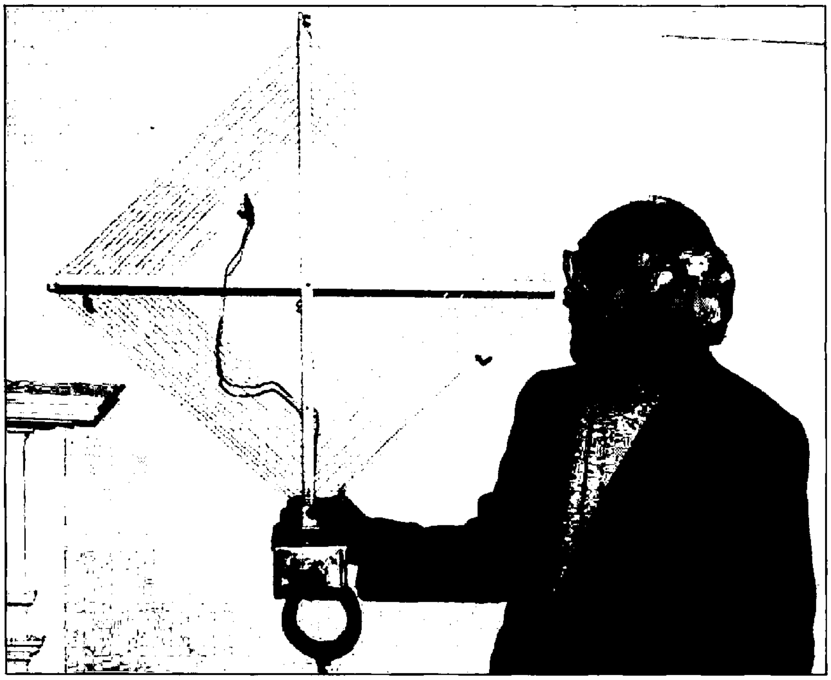


Photo A. The Square Pancake Antenna is a convenient indoor size.

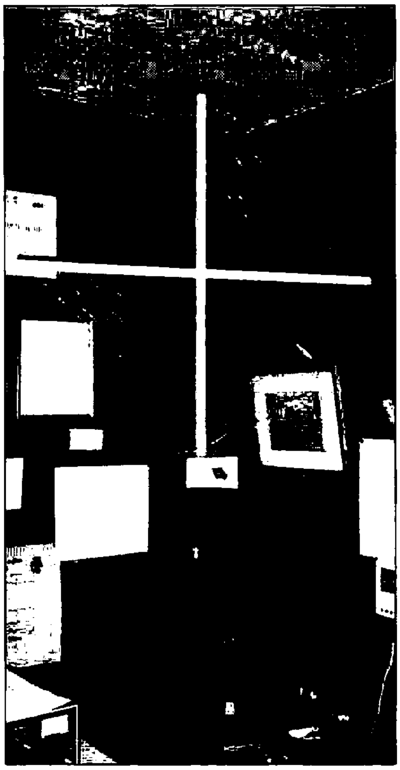


Photo B. The Pancake, over the operating desk. The tuning clip is in the 30m position.

The Tuning Capacitor

See Figure 2 for the tuning capacitor mounting details. Cut out a plywood support plate large enough to attach your tuning capacitor and the coax connector and mount it to the bottom of the vertical support piece. Mount the tuning capacitor to the bottom of the support plate and attach an SO-239 coax connector next to the back of the capacitor.

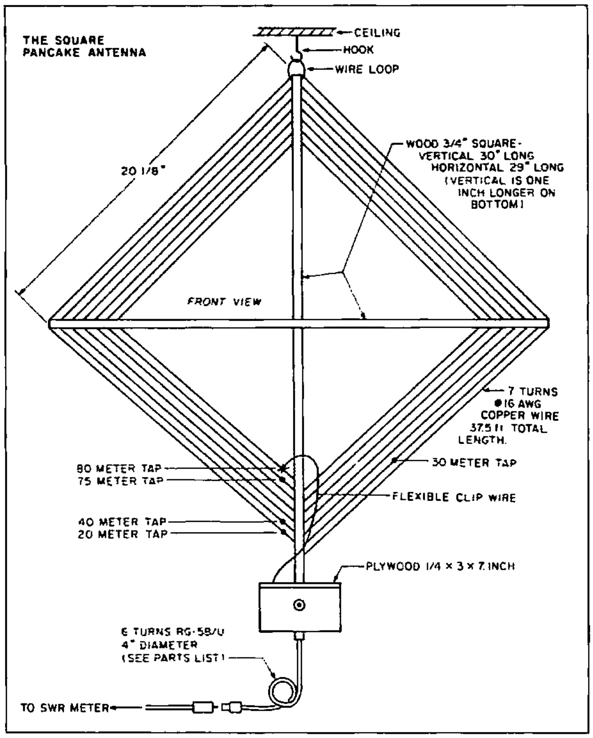


Figure 1. Front view of the Square Pancake. Note: If there is any problem when tuning a specific band, try adding the optional jumper (dotted line on the figure) to the end of the loop wire.

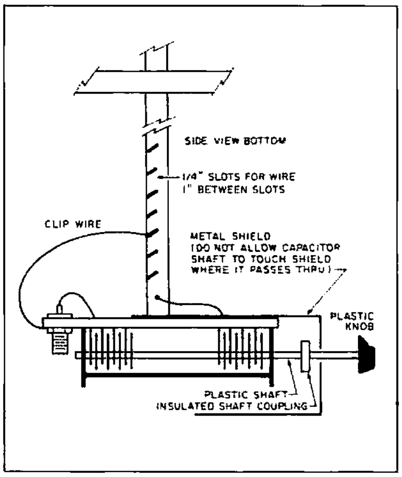


Figure 2. Side and bottom view showing the tuning capacitor arrangement.

Wire the center pin of the connector to one end of the capacitor and hook up a 2-foot clip wire (alligator clip attached on the end) to the shield of the connector. This clip wire is used to tap the loop for the various bands of interest.

Make up a shield around the front of the tuning capacitor. (DO NOT allow the capacitor shaft to touch the shield. I coupled a plastic shaft and knob to the capacitor where it passes through the shield.) You can make the shield out of a piece of aluminum or tin from a coffee can. Cut a ¾-inch slot in the shield so that it can straddle the vertical stick. I drilled four small holes in the shield and used four small bolts to fasten it to the plywood piece. Very small wood screws would also work. Attach the bottom end of the wire loop to the front end of the capacitor.

If you don't want to hang the antenna from the ceiling, you could build a small, table-top cabinet for it; but you'd have to be careful to keep children and pets away from it when using it to transmit.

The 150 pF split stator capacitor is placed in series by allowing the rotor to float. This reduces the capacity to 75 pF and doubles the voltage. If you do not plan to run over 10 to 20 watts, you could use a wide-spaced single capacitor of 75 to 100 pF. If you can't find the capacitor at a hamfest, you can use a Millen #284130 dual section variable (12–115 pF); for lower power operation (under 50 watts) try a single section Millen #23100MK (7–100 pF). Both are available from Radiokit, P.O. Box 973, Pelham NH 03076. Phone: (603) 635-2235.

Reducing Loss

You can do several things to reduce the losses of this antenna.

Use larger wire. This will, however, change the tuning.

Look for a capacitor in which the plates are welded to the mounting bars and shaft. (I am not presently using a capacitor of this type, however.)

Place a rotary switch in the middle and wire it to the tap points. The switch contacts will still cause some losses.

My feeling regarding losses is to do the best with what you have, and give it a try. All antennas have some losses.

Tuning Up

The taps shown agree with my setup. Yours will probably be different. You'll have to find them during the tune-up process.

Do all your tune-up at as low an RF power as possible.

Attach the alligator clip to the 80 meter position (at the far end of the wire). The coax from your antenna should go to your SWR meter, and from the meter to your receiver or transmitter. Set the frequency desired. In this case it would be 3500 kHz. Another tap will be required for 3750 and 4000 kHz.

Slowly adjust the antenna capacitor until the noise or a signal increases in volume. If this doesn't occur at any capacitor setting, check your wiring. If this is OK, move the tap until it does take place.

Apply as small an amount of power as possible, and adjust the capacitor until the SWR is as close to 1:1 as you can get. The SWR should not be more than 1:2. If necessary, move the tap wire and tune for lowest SWR.

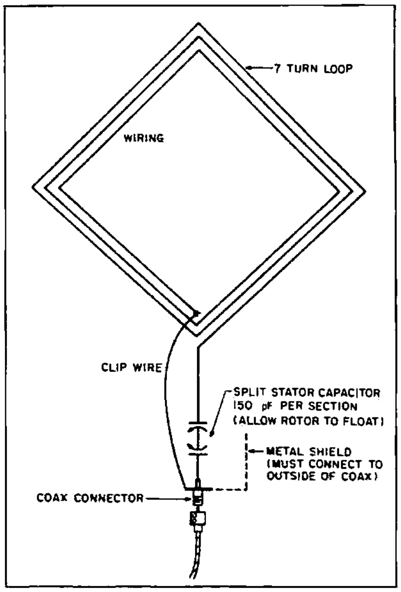


Figure 3. Wiring the Pancake.

Once you find the tap point, you should only have to use the tuning capacitor to lower the SWR from about 3500 kHz to 3750 kHz. A new tap point will be necessary for the rest of the band.

Follow the same procedure for the rest of the bands.

If you make a frequency change of over 20 kHz, you'll have to use the capacitor to tune for lowest SWR; however, you shouldn't have to move the tap until about 3750 kHz, or when you can't achieve an SWR below 1:2 by use of the capacitor only.

Once the tap points have been found, mark them for future use.

Remarks

This design is not for outside use. A very high *Q* antenna such as this is not practical outside unless it's well-protected from the elements and you use some type of motor tuning.

There are HIGH VOLTAGES present on this antenna when transmitting. Keep this fact in mind at all times.

This antenna will arouse controversy among the VIPs of antennadom. Regardless of this, give it a try and decide for yourself. You can build the whole thing in about three hours with very little expense.

You may contact Ken M. Doolittle W2SMR, Box 553, Newark Valley NY 13811.

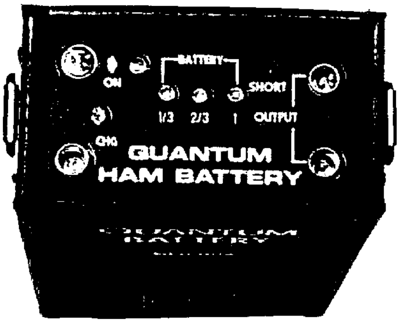
The Square Pancake Antenna

1	SO-239 coax socket	RS 278-201
6 ft.	coax and connectors	RS 278-975
38 ft.	#16 wire	solid copper
30 in.	¾ in. sq.	wood supports (2 pieces)
1	150 pF variable capacitor split stator	
1	Alligator clip	
1	Metal shield piece	

Misc: Plastic shaft and knob, coupler sleeve and necessary hardware.

73 Review *by David Cassidy N1GPH*

Quantum Instruments, Inc.
1075 Stewart Ave.
Garden City NJ 11530
Tel. (516) 222-0611; Fax: (516) 222-0569
Price Class: Ham Battery $125, HT Adapters $30.



Quantum Ham Battery

Full power for your HT.

Any professional or serious amateur photographer is probably familiar with Quantum Instruments. For over eight years, Quantum has been the leading supplier of power packs to the photographic industry. Their products have been proven to be reliable, whether it's a wedding photographer snapping candids of a radiant bride, or a news photographer slogging through the jungles of South America. Photographers the world over rely on Quantum battery packs to supply full power in the field. Quantum Instuments has now brought their experience to the amateur radio market with the introduction of the Ham Battery.

The Quantum Ham Battery is a hefty (36 oz.) power pack that will provide full, 12 volt power to your HT. There are several things that make the Ham Battery different from the standard NiCd pack. First and most importantly, the Ham Battery is not a NiCd. The attractive black case contains a sealed lead acid battery rated at 12V and 2.1 Ah. Since the battery is designed for high current drain, it can handle up to 3 amps of current draw. Also, since the battery is not a NiCd, there is no problem with "battery memory." You can recharge the battery at any time, without the risk of shortening the battery life. Since the charging circuit is fully regulated, there is no danger of overcharging.

The other big difference in everyday use is that the Ham Battery does not attach directly to the bottom of your HT. The battery is hung on your belt with a built-in belt clip, or you can use an optional shoulder strap.. An adapter is plugged into the top of the Ham Battery; the other end replaces the battery pack on your HT. You can then use your HT as a speaker/mike, or you can leave your HT on your belt and use a regular speaker/mike. The adapter is so lightweight that with most mini-HTs, it is most convenient to use the whole radio, instead of having the additional tangle of a speaker/mike.

To test the effectiveness of the Ham Battery, I subjected it to several real-world situations (if you can call the Dayton Hamvention "real world"). The Ham Battery has three green LEDs which show the approximate state of charge. They are marked "1," "2/3" and "1/3" (with "1" meaning full charge, etc). Eight hours of constant monitoring and occasional transmitting never did more than put out the first light. Hooking my HT up to a wattmeter showed that I was getting a full 5 watts out at this level (my HT's maximum output at 12V). Every evening upon returning to the hotel, I plugged the wall charger in and woke up to a fully charged battery, without the worry of NiCd battery memory.

After doing this at three separate hamfests, I figured it was time to give the Ham Battery a tougher test. The opportunity came when my car went into the shop for some repairs and I was given a loaner. I threw the Ham Battery in a dash cubbyhole, stuck a 5/8 wave mag mount on the roof and set my sights at full battery drain. This set-up took me on a six-hour trip over the weekend, and back and forth to work every day (about 1 hour/day total) for a week—without a recharge. When I returned the loaner car a week later (and gratefully went back to a full 45 watts of output on my in-dash 2 meter gear), the "2/3" light was just starting to flicker. Granted, I probably didn't transmit as much as most people. I doubt that someone who is more of a rag-chewer than I am could repeat these results, but since you're probably never more than a full day away from an AC outlet, you could probably go for years without ever seeing that last LED go out.

The Ham Battery has two output jacks, so you can power two units at once (just don't exceed 3 amps draw). You can order a coiled power cord without an HT adapter, so you could power anything that takes 12V DC. This seems like the perfect power source for taking a QRP rig on that next wilderness camping trip. In fact, there's probably a hundred different ways you could utilize a highly portable 12V power source.

Come to think of it, I'll be spending a few days in a canoe in the backwoods of Maine this month. Hmmm. . . I wonder if DXCC has a special certification for QRP canoe maritime mobile?

Indoor 10 Meter Beam

A 2-element coaxial antenna.

by Jacquelyn J. McGlothlin N9CAP

In May 1981, I wrote "The 'No Antennas' Antenna," which appeared under my former name and call, Jacquelyn Schoewe WA9BBX. It was intended to shed some light on the problems many of us face when the landlord says, "No indoor antennas!" What do you do, give up your hobby? No way! You resort to an indoor, "invisible" antenna. What is not seen will not be noticed. From the mail I received, it appears that many of you tried the indoor coaxial dipole with great success. For those of you who wish to go one step further, here's an indoor, invisible coaxial beam that will improve your signal both ways. It requires only another length of coax to turn the original dipole into a beam.

The coaxial beam antenna has the same features as the coaxial dipole. It greatly attenuates harmonics, thus lessening any TVI problems. This antenna is also very broadbanded, covering the entire 10 meter band with a VSWR under 2:1 at band edges. The broad-band characteristics are due to the feedline being matched to the antenna and electrically incorporating its own balun. The coaxial beam antenna has a definite gain over a coaxial dipole, with 5-6 dBd being typical. It is also a very "quiet" antenna; the vinyl jacket reduces static charge build-up that can cause a popping noise in the receiver when discharged.

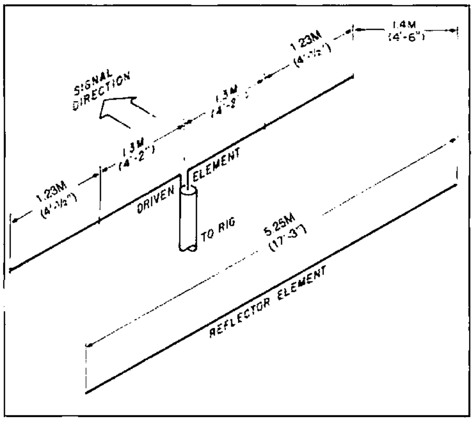


Figure 1. Element lengths for the 10 meter beam.

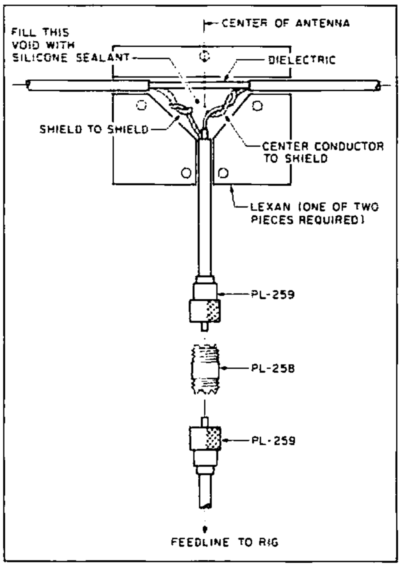


Figure 2. Feedpoint connection.

First, the Dipole

I'll begin with step-by-step construction of the 10 meter dipole, then modify it into a 2-element, 10 meter beam antenna. For antenna dimensions, see Figure 1.

Construction of the antenna is simple. RG-58A/U coax is best because it's light and flexible, but you can also use RG-8/U or RG-8X. Maximum legal power can be used with any choice of coax, providing the VSWR is under 1.5:1.

Begin construction by removing 1" (2.5cm) of vinyl jacket (1/2" on each side of center) at the center of the antenna. Cut the shield in the center all the way around the coax. Take care not to cut the dielectric or the center conductor. Next, form two leads with the shield, as shown in Figure 2. This is the feedpoint of the antenna.

From this center feedpoint, measure out each side of center 4'2" (1.3 meters) and cut the coax at that point. Remove approximately 1" (2.5cm) of vinyl jacket from each of the ends, and fold back the shield so that the dielectric is exposed. Cut and remove about an inch of this dielectric, being careful not to cut the center conductor. Then, twist the shield and center conductor together and solder. Do this at both ends. It forms the 52 ohm matching section and balun.

Next, cut two lengths of coax, each 4' 1/2" (1.23 meters) long. Then remove an inch of vinyl jacket from all four ends, fold back the shield, remove the dielectric, and twist the shield and center conductor together as before. This forms the end sections of the antenna. Attach one of these end sections to one end of the matching section by twisting together the prepared ends and soldering. In the same fashion, solder the remaining end section to the other end of the matching section. If you plan to install this antenna in an attic or outdoors, waterproof these joints as best you can. This will prevent any moisture from seeping in and deteriorating the coax. An easy method is to use heat-shrink tubing over the joint, heating it until it shrinks snugly, then wrapping it tightly with black vinyl electrical tape. Waterproofing the ends will come later, as they may need trimming for tuning purposes.

Attaching the Feedline

Refer to Figure 2. A short length of coax approximately 12" (30cm) long will do, providing it is of the same type used for construction of the antenna. Remove about 1" (2.5cm) of vinyl jacket from one end, fold back the shield, and remove the dielectric, being careful once again not to cut the center conductor. Form two leads with the shield and center conductor. At the feedpoint of the antenna, connect this feedline by soldering the feedline center conductor to one of the feedpoint leads. Then solder the feedline shield to the remaining lead. Waterproof this area if desired, being sure that the feedpoint leads do not touch each other and short out. One method is to cut two pieces of 1/4" (6.5mm) thick Lexan or similar material into a 3" x 4" (7.5cm x 10cm) shape.

Using a router or hand chisel, remove enough of the material inside each half so that it will make for a snug fit over the feedpoint. Fill this area with silicone sealant such as RTV prior to sandwiching the halves together. Drill holes through both pieces at a few locations to allow for several screws, nuts, and lockwashers to hold the unit tightly together. Drill a hole at roughly the center top portion of this insulator block so that a small nylon rope may be passed through it for supporting the center of the antenna later. At the opposite end of the feedline, attach a PL-259 connector and a PL-258, also called a barrel connector. Then prepare a random length of

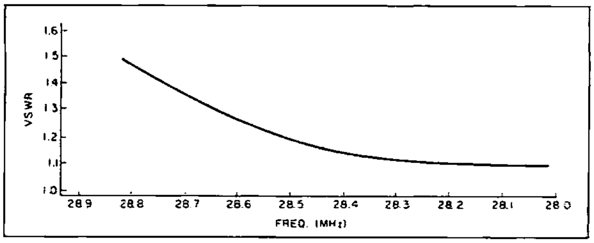


Figure 3. VSWR curve.

coax long enough to reach from the antenna to your rig and attach PL-259s to both ends. This will allow you to easily switch from one antenna to another, if desired, merely by unscrewing the feedline and attaching it to another antenna of your choice.

Erecting the Antenna

In choosing a location, be sure to allow enough room for an additional element running parallel to and approximately 4'6" (1.4 meters) away from the antenna. It should also be oriented in your favorite direction, as indicated by the arrow in Figure 1. An attic or crawl space will provide ample room in most cases. Try to erect as much of it as possible in a straight line, keeping it as far away from large metal objects as feasible. The ends may hang down as long as they don't touch any nearby metal objects. Monofilament fishing line tied in a series of half-hitches along the vinyl jacket ends of antenna will do nicely for anchoring it. The line will bite into the vinyl as it is pulled taunt.

If you don't have an attic or access to one, the antenna may be stapled to a ceiling with plastic cable ties or any other non-conducting material as support. Wrap the cable ties around the antenna at intervals and staple the free ends of the ties to the ceiling. Do not staple directly through the antenna itself. Again, the ends may hang down if need be, providing they don't touch any nearby metal objects.

Tuning the Antenna

After erecting the antenna, check VSWR and trim the ends if needed, keeping track of the total amount trimmed. I used a design frequency of 28.5 MHz for tuning purposes. Be sure to twist the ends of the antenna as before (shield to center conductor), then recheck VSWR. The antenna will interact with any hidden wiring in the walls or ceiling, so a considerable amount may have to be trimmed from each end. Try to achieve a preliminary VSWR of 1.5:1 or 1.6:1 at the design frequency of your choice. This completes construction of the coaxial dipole at this point, so now we'll call it the driven element, and continue its transformation into a 2-element beam antenna.

The 2-element Transformation

The reflector element which we'll add requires only another length of coax, the same type used for construction of the driven element. To determine the length of the reflector, note the total amount, if any, trimmed from the driven element (you did keep track, didn't you?). Subtract this from the total starting length of 17'3" (5.25 meters) to derive the actual length. This is the length required for the reflector element.

Cut a new length of coax to that dimension and prepare each end as you did with the driven element, then twist together as before (shield to center conductor). Erect this element in the same manner, being sure to align it parallel to the driven element and centered as best as you can so that an equal amount from each end extends beyond the ends of driven element. It should be placed 1.4 meters 4'6" (1.4 meters) behind driven element for 0.13-wavelength spacing, or 9 feet (2.8 meters) for 1/4-wavelength spacing if you have the room for it. A slightly better front-to-back ratio will result. I had to use 0.13-wavelength spacing because of limited ceiling space, but it still provides overall good performance.

Now, check the VSWR again. You may find that it has risen from the last check, so trim the ends of the reflector element as needed, making sure you trim the same amount from driven element ends at the same time. Final VSWR checks run on the antenna at my QTH gave the results shown in Figure 3. Once you have gotten the VSWR down to an acceptable level, solder all four ends of the antenna and waterproof them if desired. This completes construction.

On-the-Air Results

Comparing the beam antenna to a coaxial dipole, there was a definite increase of 2 S-units, indicating a moderate gain of 5-6 dBd. Front-to-back ratio is not very much, so contacts off the back should be of sufficient signal strength for solid copy both ways. Should you desire to change direction of the antenna 180 degrees, you can convert the reflector element to a director element simply by trimming the ends so that it is 5% shorter in length than the driven element.

This is especially handy on 10 meters when winter European DX fades and summer South American DX predominates. If you like to experiment, a third director element 5% shorter than the driven element can be added for additional gain and front-to-back ratio. Or perhaps a 15 meter beam would appeal to you. Experiment! The possibilities are varied and intriguing!

With this antenna in use at my apartment QTH for over a year, I've been able to work many areas of the world with solid copy both ways that previously weren't strong enough to copy on the dipole for a QSO. Stations have expressed amazement or total disbelief about my antenna, but also provided some very interesting QSOs! Once you start enjoying the pleasures of DXing from your apartment or condo with an indoor beam antenna, I'm sure you'll raise many eyebrows, too! Happy DXing. ■

You may write Jacquelyn J. McGlothlin N9CAP, 2761A So. Logan Ave., Milwaukee WI 53207. Please enclose an SASE.

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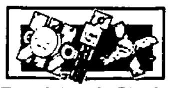

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Economical Mobile HF Antenna

Modify a CB antenna for the ham bands.

by John Portune AA6NG

When you think "mobile HF antenna," what comes to mind? Big and ugly? If so, you're normal. Little wonder so many hams have turned, in just the last three decades, to the convenience of VHF and UHF repeaters. Yet mobile HF still offers many advantages. On long trips and in remote areas, it is unequalled for fun and safety.

I couldn't bear the thought of a gigantic loading coil, a ball and a spring, on my new, small car. Fortunately, I found an answer. This article describes that solution—a modified commercially-built, base-loaded CB antenna. It has proven itself remarkably efficient, as well as an attractive partner to my diminutive new car and modern mobile transceiver.

Perfect for Modification

The current model Radio Shack 21-908A Trunk Lid Mobile CB antenna ($26.95) is ideally suited for conversion to HF. It has a loading coil that comes apart, making it easy to rewind, and is shunt-fed, making it easy to match. This second feature is very important.

In the past, HF rigs had output tuning networks which could match the low impedance of a mobile whip. Today, however, many mobile rigs are "no tune." They must see a 50 ohm load to function correctly. An antenna, therefore, must not only be tuned, but also impedance-matched, before it can accept power from such a rig. The preferred way is to add an additional small shunt coil from the feedpoint to ground. The Radio Shack antenna has this feature built in. A ball-and-spring setup does not.

Since modifying the first of several of these antennas, I have operated them on most of the ham HF bands, and have rarely been disappointed by an unanswered CQ. The little antenna has proven to be a winner.

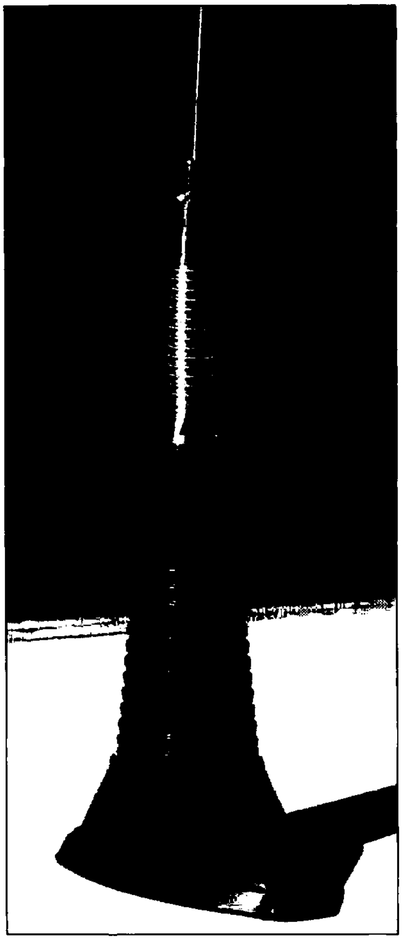

Photo A. This antenna is rugged, attractive, and easily mounted on the trunk lid. The whip may be adjusted in length by loosening the set-screw.

A Magnetic Mount Version

This same antenna also comes in a magnetic version, model 21-940. I had originally hoped to use it. But there is a problem. A magnetic mount relies on capacitive coupling to the car's metal body. It effectively adds (see Figure 1) a capacitor (Cm) in series with the antenna.

For 20 meters and higher, this is not a problem. But as the frequency gets lower, the reactance of this capacitor will eventually exceed 50 ohms. When it does, there is no 50 ohm tap point on the loading coil.

The trunk lid mount, with a real electrical ground, eliminates the problem. But if you are content with 20 meters and above, you

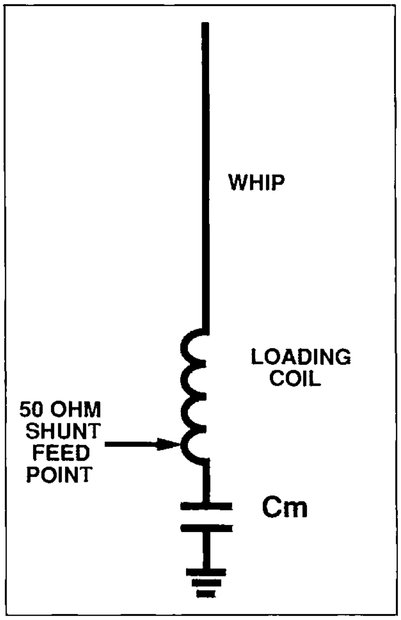

Figure 1. The circuit of the antenna on a magnetic mount. "Cm" is the effective capacity of the mount. At lower frequencies, the reactance of "C" exceeds 50 ohms, and impedance matching is not possible.

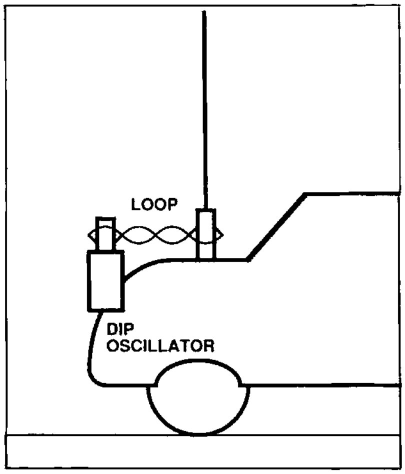

Figure 2. The resonant frequency of the antenna may easily be determined with a dip oscillator coupled to the antenna by a loop of twisted hook-up wire. Keep away from the antenna when dipping. The antenna feedline should be connected to the transceiver during the measurement.

may wish to use the magnetic mount. Some additional turns will have to be added to the coils, however, to counteract for the series capacity of the mount.

Modifying the Loading Coil

The loading coil is easily pushed out of the gray plastic housing for rewinding by pressing the threaded stud against a firm surface. Two well-placed O-rings protect the assembly from the weather. Be careful of these during modification, as they are easy to damage.

Notice that the coil has two sections. Tuning of the antenna is accomplished mostly by the upper coil, the impedance match by the lower. The feed from the center conductor of the coax is a shunt tap between the two coils.

The correct number of turns and wire gauge for each band is given in the table. The values are for the center of the band. Operation on 80 meters with this antenna is impractical due to the small diameter of the wire that is required.

You will also have to perform minor surgery on the plastic coil form. It comes with molded ridges to space the windings of the CB coil. For all but 10 meters, these should be removed with a coarse file or a hobby knife. A slight touch of the soldering iron will secure the new windings. Be sure to use the wire size listed. Also, wind all turns tightly together at the bottom. Different sizes of wire, or spaces between turns, will significantly change the number of turns required.

Tuning the Antenna

Once the completed antenna is assembled and installed on the car, tuning may be accomplished. This is not difficult, but it is touchy, owing to the size of the antenna. The smaller a loaded mobile whip, the narrower its operating bandwidth. Also, the bandwidth becomes more critical as the frequency goes down. On 10 meters the bandwidth is quite broad, but on 40 meters it is very narrow.

You will, therefore, have to slightly alter the number of turns on the loading coil for the specific spot on the band where you operate, especially on the lower bands.

A small amount of tuning is also possible during operation by adjusting the length of the whip. Use a turn or two less on the coil than for the frequency where you operate, with the whip all the way in. Then, by extending the whip, you will be able to lower the frequency to your precise operating point.

I leave a small SWR bridge in the feedline mounted near the transceiver. On low-power tune position, it is easy to find where the antenna is tuned—it's where the SWR is at a minimum. I then adjust the length of the whip until the antenna is perfectly tuned for my operating spot.

More Energetic Changes

If you wish to depart from the listed values more than a little, such as to build a version for a band not shown, you can use the help of a dip oscillator.

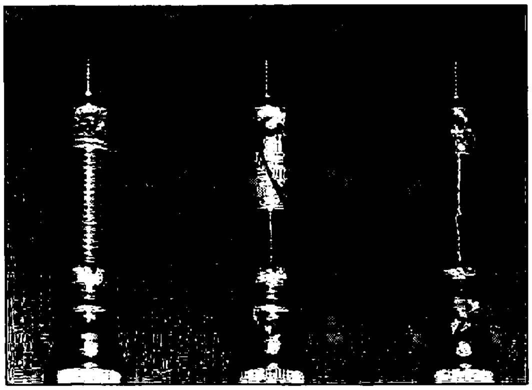

Photo B. Loading coils for three bands. Left to right are 10m, 20m, and 40m. Notice the spacing ridges on the 10m coil. Revolve these, and close wind coils for all other bands.

To do so, mount the antenna on the car and connect it to your transceiver (an open feedline will alter the operating frequency). Leave the gray plastic cover off of the loading coil during tuning.

Make a temporary coupling loop out of solid-conductor insulated hook-up wire, or from wire-wrap wire. See Figure 2. This loop will let you "dip" the antenna, to find its resonant frequency, without being too near it and changing its resonant frequency by body capacitance.

It is also a good idea to check out the test setup first with a known antenna, such as the stock CB version, before removing or adding turns.

First use your transceiver's receiver to verify the calibration of the dip oscillator on 10 meters. Then see if the stock antenna dips in the CB band (Channel 19 = 27.185 MHz). Then make a small modification to the coil. The dip oscillator will give you a fair indication of how far you have moved the resonant frequency. Repeat this process until you are inside the desired band.

You will then be able, using your transceiver and an SWR bridge, to locate the exact frequency that the antenna is resonant to. The SWR will be lowest at this frequency.

The necessary number of turns for the matching section of the loading coil is found by noticing how low you are able to get the SWR as you cross the band with a brief test transmission. Add or subtract a turn at a time until the SWR is near 1:1 at the resonant frequency of the antenna.

A Word About Power

Finally, be cautious about power. I use the antenna satisfactorily with an average 100 watt SSB mobile radio. But it is possible to exceed the power limitations of the antenna (the steady carrier power limit is 25 watts). The RF current in a short mobile antenna can be quite high, especially on the lower frequencies. Therefore, avoid more than brief key-down steady carrier situations. The loading coil could melt. Normal SSB voice transmissions will not be a problem.

An Attractive Compromise

Admittedly, from the purist's point of view, this little antenna lacks some in theoretical efficiency. A longer whip, a larger loading coil, or a capacitive hat would technically improve performance. But getting away from these is the object of the design.

By actual measurement, these changes would only offer minor improvement. To me, it's a small price to pay for the fact that I am one of the few in my ham circle who continues to enjoy HF mobiling in the days of tiny modern cars. The only drawback I've encountered is snide remarks from ham friends about a "good buddy" antenna on my car. They think I'm a traitor. I just smile and leave them in ignorance. ■

You may contact John Portune AA6NG at 724 Celestial Lane, Foster City CA 94404. If you request info, please include an SASE.

Turns Required on Loading Coil

Band	Upper Coil Turns (AWG)	Lower Coil Turns (AWG)
10m**	18 (*)	3.5 (*)
15m	21 (21)	3.5 (*)
20m	42 (21)	3.5 (*)
40m	82 (28)	5.5 (21)

*Existing AWG.
**Radio Shack recommends cutting the whip for 10m operation. However, the antenna will be more efficient if you rewind the coils according to this chart.

Number 9 on your Feedback card

DXDA '91
The Dynasty Grows . . .

73 *Magazine* welcomes the new members to the growing DX dynasty Award cadre! Special thanks to DXDA chairman Bob Reed WB2DIN for processing the results. Congratulations to all for a job well done.

BASIC AWARD—100 COUNTRIES WORKED

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14. K9GBN
15. N5GAP
16. WB3FMA
17. NN6E
18. AL7HG
19. N6CGB
20. KI6AN
21. K9JPI
22. N4WF
23. K6PKO
24. KW7J
25. VE6JO
26. WA4IUV
27. W4ZFE
28. N4KMY
29. WØHBH
30. K8KJN
31. KG1V
32. K1KOB
33. KY3F
34. PY2JY
35. YB5BEE
36. YB5BEH
37. WB9SBO
38. NOAFW
39. KA9MOM
40. N3II
41. W6DPD
42. KE8GG
43. VE6VK
44. KD9RD
45. W4WJJ
46. KØHSC
47. KI6GI
48. IK1APP
49. KJ4RR
50. K8MDU
51. N1EIU
52. K1DRN
53. WD8REC
54. ZL2BLC
55. VE3EFX
56. W9MCJ
57. N6IV
58. KN8D
59. KC5YQ
60. WB6ITM
61. KA2AOT
62. K4LHH
63. VE2QO
64. KE5AT
65. W9SU
66. W3OOU
67. NR2E
68. KF5PE
69. N3FBN
70. KB4SJD
71. N3EZX
72. IK8GCS
73. WB4I
74. NG1S
75. WB7UUE
76. HK4EB
77. KØBFR
78. N7GMT (KF7SH)
79. AA4VN
80. KA1LMR
81. N8AXA
82. NM2I
83. KD9YB
84. HC2CG
85. VE1BXI
86. YC2OK
87. NRGNL
88. GM3UBF
89. 5Z4BP
90. IØAOF
91. VE1BN
92. KA2NRR
93. 5Z4DU
94. KB8ZM
95. HK4CCW
96. W2JQ
97. HC2AGT
98. WD5N/M
99. VE1BHR
100. VE1AGZ
101. K5AOB
102. KW2D
103. PY3ARZ
104. WB4ETD
105. N2FPB
106. KD3CQ
107. K4NNK
108. VU2DNR
109. AA5BE
110. PY3OG
111. VE4ACF
112. VE4SI
113. PJ2KI
114. WB4CKY
115. W6EQB
116. KK4IY
117. IK1IYU
118. N6GCN
119. KB1AF
120. KB8BHE
121. KE2CG
122. VS6CT
123. G3IZQ/W
124. WB6FNI
125. KAØIAR
126. K9SM
127. W6BCQ
128. KA5MSL
129. WB4FLB
130. N7GLT
131. WAØX
132. KF4GW
133. N4QGH
134. VE1CBK
135. 7J1AAL
136. K6ICS
137. NZ7W
138. WBØN
139. WC7F
140. F6IFE
141. KL7N
142. KE8LM
143. WA6YOO
144. VE2MFD
145. N3APQ
146. HK1DBO
147. NM3V
148. IK6GFY
149. WB6UAN/M
150. NK6Z
151. KB6IUA
152. W9OKH
153. WB5FXT
154. NB3E
155. N2ESP
156. YU2EJU
157. OZ1DXX
158. IK5IIU
159. KA1ION
160. KD3AI
161. OK1AEH
162. W9LCR
163. 8P6SH
164. KA6SPQ
165. ZF2KH
166. W6MVV
167. JA8CAQ
168. KI6WF
169. K2MRB
170. AA6GM
171. JAØSU
172. NU8Z
173. GØGRK
174. YB8VM
175. DV1BRM
176. WØTU
177. N7CNH
178. PY3IO
179. YBØZCA
180. YBØAF
181. VE3PQB
182. W2SV
183. N1ADE
184. WP4AFA
185. KS7V
186. W2OFB
187. G4ASL
188. N5JUW
189. KA8WAS
190. 5NØWRE
191. AA4IP
192. JR5KDR
193. KD2WQ
194. KA3NIL
195. WA8YWK
196. VE1ACK
197. HP2XVB
198. WB5KYK
199. N5JUJ
200. N4OBJ
201. 9Q5NW
202. KW2D
203. VE1HA
204. HP8BSZ
205. IK8JJQ
206. YC3DKN
207. I3VKW
208. K2EWA
209. KD3CR
210. N9GDG
211. KF8K
212. FD1BEG
213. DU1DZA
214. N8IMZ
215. KK4YA
216. LU1JDL
217. KA8YYZ
218. KA4TMJ
219. WA9DDC
220. YI1CIS
221. YC3FNL
222. GØFWG
223. KV4B
224. N5IET
225. WA9WIG
226. N3CDA
227. KE6KT
228. IK7DBB
229. JY5EC
230. N1ETT
231. PY2DBU
232. I8IYW
233. NØISL
234. KC4BEB
235. WA7QQI
236. KA1RJG
237. OZ9BX
238. KB4HBH
239. KA3RWP
240. NJIT
241. W4DCG
242. YCØRX
243. VE7OJ
244. AA4W
245. N9GMM
246. KB4HBH
247. KM4HF
248. CE1YI
249. KA1FVY
250. N2GVB
251. N2DAO
252. WF8E
253. YBØHZL
254. N5MBD
255. N4SNS
256. KA3TGY
257. JN3XLY
258. N4DUV
259. KA9MRU
260. KA4OTB
261. N4JED
262. AB4KA
263. WA7OET
264. KA3RVH
265. CE7ZK
266. NI9J
267. WB9PTN
268. KB8DAE
269. WØCL
270. WB7VUB
271. JF6TUU
272. ZY3IO
273. KB4VIR
274. OE6CLD
275. N7JJO/DU3
276. KK4FB
277. DU1AUJ
278. K2EWB
279. NI5D
280. N2JXC
281. NØIWT
282. WB3BDH
283. K1CVF
284. KA3CXG
285. KA1SPO
286. WA4NWT
287. KJ4OI
288. KA3UNQ
289. WB2VMV
290. KD4MM
291. OE3DHS
292. KD9HT
293. DL8OBC
294. G3KVA
295. WA4NEL
296. KA4VZO
297. NØIDT
298. KA1FUE
299. KD7EO
300. JH8MWW
301. KB8ICD
302. JA1CKE
303. N3GEE
304. JA5MG
305. KA1FTU
306. WA8KMK
307. N2IBW
308. N4THE
309. N3CYD
310. JA4TF
311. W6YLL
312. WA1S
313. KC5WA
314. N6WK
315. PY4OY
316. KG7BO
317. WB3FQY
318. WCØA
319. VE4AMU
320. YCØMCA
321. WA3LEU
322. KB2GLO
323. OZ1FNX
324. K6GCF
325. KC4PCX
326. KA7EXD
327. DK9EA
328. HL5AP
329. SM7BRO
330. ON6DP

150 COUNTRIES ENDORSEMENT

1. WB2DIN
2. N4WF
3. N6GCB
4. K9FD
5. NØAFW
6. N3II
7. WB1BVO
8. KA2AOT
9. KI6GI
10. N7GMT
11. IK8GCS
12. IK1APP
13. VE6JO
14. VE4ACF
15. WB4I
16. IK1IYU
17. KE2CG
18. G3IZQ/W1
19. WB6FNI
20. K8MDU
21. VE6VK
22. KB6IUA
23. WB5FXT
24. YU2EJU
25. IK5IIU
26. KE8LM
27. KA1ION
28. KA6SPO
29. W6MVV
30. JA8CAQ
31. KI6WF
32. JAØSU
33. WD5N
34. W2SV
35. W6BCO
36. F6IFE
37. VE2MFD
38. WP4AFA
39. 5NØWRE
40. KD2WQ
41. VE1ACK
42. N5JUJ
43. 9Q5NW
44. KB8BHE
45. I3VKW
46. KD3CR
47. N8IMZ
48. GØFWG
49. N2FPB
50. KE6KT
51. OZ9BX
52. NJ1T
53. CE1YI
54. YBØHZL
55. JN3XLY
56. KA9MRU
57. CE7ZK
58. KB8DAE
59. K2EWB
60. NI5D
61. KD3CQ
62. KA4OTB
63. WB2VMV
64. KD4MM
65. KD9HT
66. KA3NIL
67. NØIDT
68. KA1TFU
69. KA4TMJ
70. JA4TF
71. KA3UNQ
72. KB8ZM
73. K2EWA
74. WA1S
75. PY4OY
76. WCØA
77. OZ1FNX
78. KA7EXD
79. ON6DP

200 COUNTRIES ENDORSEMENT

1. N3II
2. WB2DIN
3. K9FD
4. IK8GCS
5. NØAFW
6. WB1BVO
7. VE4ACF
8. KI6GI
9. N6GCB
10. K8MDU
11. YU2EJU
12. KE8LM
13. WD5N
14. F6IFE
15. 5NØWRE
16. KE2CG
17. I3VKW
18. CE1YI
19. W6BCQ
20. CE7ZK
21. KB8DAE
22. K2EWB
23. KD3CQ
24. KD4MM
25. KD9HT
26. KA4TMJ
27. N7GMT
28. JA4TF
29. K2EWA
30. WA1S
31. PY4OY
32. ON6DP

250 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. WD5N
4. K8MDU
5. KE2CG
6. CE1YI
7. CE7ZK
8. K2EWB
9. KD9HT
10. N7GMT
11. KD3CQ
12. KB8DAE
13. WA1S
14. PY4OY

300 COUNTRIES ENDORSEMENT

1. WB2DIN
2. IK8GCS
3. K2EWB
4. K8MDU
5. N7GMT
6. WA1S
7. PY4OY

350 COUNTRIES ENDORSEMENT

1. WB2DIN

Official DX Dynasty Countries List: 09/01/91

Country	Prefix
ABU AIL	A15
AFGHANISTAN	YAØ
AGALEGA ISLAND	3B6
ALAND ISLANDS	OHØ
ALASKA	KL7
ALBANIA	ZA
ALDABRA ISLAND	VQ9
ALGERIA	7X
AMERICAN SAMOA	KH8,AH8,(KS6)
AMSTERDAM ISLAND	FT4
ANDAMAN ISLAND	VU4
ANDORRA	C3
ANGOLA	D2,D3
ANGUILLA	VP2E
ANNABON ISLAND	3CØ
ANTARCTICA	KC4
ANTIGUA	V2
ANTIPODES ISLAND	ZL
ARAN ISLAND	EJØ
ARGENTINA	LU
ARMENIA	UG
ARUBA	P4
ASCENSION ISLAND	ZD8
AUCKLAND ISLAND	ZL9
AUSTRAL ISLANDS	FOØ
AUSTRALIA	VK
AUSTRIA	OE
AVES ISLAND	4MØ
AZERBAIJAN	UD
AZORES ISLANDS	CT2
BAHAMA ISLANDS	C6
BAHRAIN	A9
BAKER ISLAND	KH1,(KB6)
BALEARIC ISLANDS	EA6
BANABA ISLAND	T33
BANGLADESH	S2
BARBADOS	8P6
BEAR ISLAND	JW
BELGIUM	ON
BELIZE	V3
BENIN	TY
BERMUDA	VP9
BHUTAN	A5
BOLIVIA	CP
BONAIRE	PJ9
BONIN	JD1
BOPHUTHATSWANA	H5
BOTSWANA	A2
BOUNTY ISLAND	ZL
BOUVET ISLAND	3Y
BRAZIL	PP-PY
BRIT CYPRUS	ZC
BRITISH VIRGIN ISLANDS	VP2V
BRUNEI	V8
BULGARIA	LZ
BURKINA FASO	XT
BURMA	1Z
BURUNDI	9U
BYELORUSSIA	UC
CAMEROON	TJ
CAMPBELL ISLAND	ZL4/A
CANADA	VE
CANARY ISLANDS	EA8
CAPE VERDE ISLANDS	D4
CAPRI ISLAND	IC
CAYMAN ISLANDS	ZF
CELEBES	YB
CENTRAL AFRICAN REPUBLIC	TL
CENTRAL KIRIBATI	T3
CEUTA AND MELILLA	EA9
CHAD	TT
CHAGOS	VQ9
CHATHAM ISLAND	ZL
CHESTERFIELD ISLAND	FK8
CHILE	CE
CHINA	BY
CHRISTMAS ISLAND	VK9X
CISKEI	S4
CLIPPERTON ISLAND	FOØ
COCOS ISLAND	TI9
COCOS KEELING ISLAND	VK9Y
COLOMBIA	HK
COMINO ISLAND	9H
COMOROS	D6
CONGO	TN
CONWAY REEF	3D2
COOK ISLAND	ZK1
CORSICA	TK
COSTA RICA	TI
CRETE	SV9
CROZET ISLAND	FT8W
CUBA	CO
CURACAO	PJ
CYPRUS	5B4
CZECHOSLOVAKIA	OK,OL
DENMARK	OZ
DESECHEO ISLAND	KP5
DESROCHES	VQ9
DIEGO GARCIA	VQ9
DJIBOUTI	J2
DODECANESE ISLANDS	SVØ
DOMINICA	J7
DOMINICAN REPUBLIC	HI
EAST CAROLINE ISLANDS	KC6
EAST GERMANY	Y2-Y9
EAST KIRIBATI	T3
EASTER ISLAND	CEØ
ECUADOR	HC
EGYPT	SU
EL SALVADOR	YS
ENGLAND	G
EQUATORIAL GUINEA	3C
ESTONIA	UR,ES
ETHIOPIA	ET
EUROPA ISLAND	FR/E
FALKLAND ISLANDS	VP8
FAROE ISLANDS	OY
FARQUHAR	VQ9
FERNANDO DE NORONHA	ZYØ
FIJI ISLANDS	3D2
FINLAND	OH
FRANCE	F
FRANZ-JOSEF LAND	UA1
FRENCH GUIANA	FY
FUTUNA ISLAND	FW
GABON	TR
GALAPAGOS ISLAND	HD8
GAMBIA	C5
GEORGIA	UF
GHANA	9G
GIBRALTAR	ZB2
GLORIOSO ISLAND	FR/G
GOUGH ISLAND	ZD9
GOZO ISLAND	9H4
GRAHAM LAND	VP8
GREECE	SV
GREENLAND	OX
GRENADA	J3
GUADELOUPE	FG
GUAM	KH2,(KG6)
GUANTANAMO BAY	KG4
GUATEMALA	TG
GUERNSEY	GU
GUINEA	3X
GUINEA-BISSAU	J5
GUYANA	8R
HAITI	HH
HAWAII	KH6
HEARD ISLAND	VKØ
HONDURAS	HR
HONG KONG	VS6
HOWLAND ISLAND	KH1,(KB6)
HUNGARY	HA
ICELAND	TF
IFNI	EA9
INDIA	VU
INDONESIA	YB,YC,YD,YE
IRAN	EP
IRAQ	YI
IRELAND	EI
ISCHIA	IC
ISLE OF MAN	GD
ISRAEL	4X,4Z
ITALY	I-IZ
IVORY COAST	TU
JABAL ATTAIR	??
JAMAICA	6Y
JAN MAYEN ISLAND	JX
JAPAN	JA
JARVIS ISLAND	KH5J,(KP6)
JAVA	YCØ
JERSEY	GJ
JOHNSTON ISLAND	KH3,(KJ6)
JORDAN	JY
JUAN DE NOVA ISLAND	FR/J
JUAN FERNANDEZ ISLAND	CEØ
KALININGRAD	UZ2
KAMARAN ISLAND	VS9
KAMPUCHEA	XU
KAREN NATIONAL UNION	1Z9
KAZAK	UL
KENYA	5Z
KERGUELEN ISLAND	FT8X
KERMADEC ISLAND	ZL1/K
KINGMAN REEF	KH5K
KIRGHIZ	UM
KOREA	HL,HM
KURE ISLAND	KH7
KUWAIT	9K
KWAJALEIN	KX6
LABRADOR	VO2
LACCADIVE ISLANDS	VU7
LAMPEDUSA ISLAND	IG9
LAOS	XW
LATVIA	UQ
LEBANON	OD
LESOTHO	7P
LESSER ANTILLES	PJ
LEVANZO ISLAND	IF9
LIBERIA	5L
LIBYA	5A
LIECHTENSTEIN	HBØ
LINE ISLANDS	T3L
LITHUANIA	UP
LORD HOWE ISLAND	VK9
LUXEMBOURG	LX
M-V ISLAND	4J
MACAO	XX
MACQUARIE ISLAND	VKØ
MADAGASCAR	5R
MADDALENA ISLAND	IM
MADDONA DE MONTE IS	IL
MADEIRA ISLAND	CT3
MALAWI	7Q
MALAYSIA	9M2
MALDIVE ISLANDS	8Q
MALI	TZ
MALPELO	HKØ
MALTA	9H
MANIHIKI	ZK1
MARCUS ISLAND	JD
MARIANA ISLAND	KHØ,(KG6)
MARION ISLAND	ZS2
MARKET REEF	OJØ
MARQUESAS ISLAND	FO/M
MARSHALL ISLAND	V73
MARTIM VAS ISLAND	PYØ
MARTINIQUE	FM
MAURITANIA	5T
MAURITIUS ISLAND	3B8
MAYOTTE	FH
MEXICO	XE
MIDWAY ISLAND	KH4,(KM6)
MINAMI TORI SHIMA	7J
MIQUELON ISLAND	FP8
MOLDAVIA	UO
MONACO	3A
MONGOLIA	JT
MONTSERRAT	VP2M
MOROCCO	CN
MOUNT ATHOS	SY
MOZAMBIQUE	C9
NAMIBIA	ZS3
NAURU	C2
NAVASSA ISLAND	NP1
NEPAL	9N1
NETHERLANDS	PA
NETHERLANDS ANTILLES	PJ2
NEVIS ISLAND	V47
NEW CALEDONIA	FK1
NEW HERBRIDES	YJ
NEW ZEALAND	ZL
NEWFOUNDLAND	VO1
NICARAGUA	YN1
NICOBAR ISLAND	VU4
NIGER	5U
NIGERIA	5N
NIUE ISLAND	ZK2
NORFOLK ISLAND	VK9
NORTHERN IRELAND	GI
NORWAY	LA
OGASAWARA ISLAND	KA2
OKINO TORI SHIMA	7J
OMAN	A4
PAKISTAN	AP
PALMYRA ISLAND	KH5
PANAMA	HP1
PANTELLERIA ISLAND	1H
PAPUA NEW GUINEA	P2
PARAGUAY	ZP
PENGUIN ISLANDS	ZS9
PERU	OA
PETER 1ST ISLAND	3Y2
PHILIPPINES	DU-DZ,4F
PHOENIX	T3P
PITCAIRN ISLAND	VR6
POLAND	SP9
PONZIANI ISLAND	IBØ
PORTUGAL	CT
PRINCE EDWARD ISLAND	ZS2
PRINCE EDWARD ISLANDS	VE1
PRINCIPE	S9
PRIVILOF	KL7
PROVIDENCIA ISLAND	HKØ
PUERTO RICO	KP4
QATAR	A7
RAPA ISLAND	FO8
REUNION ISLAND	FR4
REVILLA GIGEDO ISLAND	XF4
RODRIGUEZ ISLAND	3B9
ROMANIA	YOØ
RONCADOR CAY	HKØ
ROTA ISLAND	KHØ
ROTUMA ISLAND	3D2
RUSSIA-SIBERIA	UAØ
RUSSIAN S.F.S.R.	UZ6
RUSSIAN-URAL MT	UZ9
RWANDA	9X
RYUKYU ISLAND	JR6
SABA ISLAND	PJ7
SABAH	9M6
SABLE ISLAND	CYØ
SAIPAN	N6
SAKHALIN ISLAND	RFØ
SAN ANDRES ISLAND	HKØ
SAN FELIX ISLAND	XQØX
SAN MARINO	T7
SAO TOME	S9
SARAWAK	9M8
SARDINIA	IS
SAUDIA ARABIA	HZ
SCOTLAND	GM
SENEGAL	6W
SERRANA BANK	HKØ
SEYCHELLES	S79
SICILY	IT9
SIERRA LEONE	9L
SINGAPORE	9V1
SINT EUSTATIUS	PJ8
SINT MAARTEN ISLAND	PJ
SMOM (MALTA)	1AØ
SOCIETY ISLAND	FOØ
SOCOTRA ISLAND	7O
SOLOMON ISLANDS	H44
SOMALI REPUBLIC	T5
SOUTH AFRICA	ZS,ZR
SOUTH GEORGIA ISLAND	VP8
SOUTH ORKNEY ISLAND	VP8
SOUTH SANDWICH ISLAND	VP8
SOUTH SHETLAND ISLAND	CXØ
SOUTH YEMEN	7O
SOUTHERN SUDAN	STØ
SPAIN	EA
SPRATLY ISLAND	IS
SRI LANKA	4S
ST BRANDON ISLAND	3B7
ST HELENA ISLAND	ZD7
ST KITTS	V44
ST LUCIA	J6
ST MARTIN ISLAND	FS,/FG
ST PAUL ISLAND	CY9
ST PETER AND PAUL ROCKS	ZYØ
ST PIERRE ISLAND	FP5
ST VINCENT	J8
SUDAN	ST
SUMATRA	YB4
SURINAM	PZ1
SVALBARD ISLAND	JW6
SWAN ISLAND	HRØ
SWAZILAND	3D6
SWEDEN	SM
SWITZERLAND	HB9
SYRIA	YK
TADZHIK	UJ8
TAIWAN	BV
TANZANIA	5H3
TASMANIA	VK7
THAILAND	HS
TINIAN	KHØ,(KG6)
TOGO	5V
TOKELAU	ZK3
TONGA ISLAND	A3
TRANSKEI	S8
TRANSVAAL	T4
TRINIDADE ISLAND	ZYØ
TRINIDAD & TOBAGO	9Y
TRISTAN DE CUNHA	ZD9
TROMELIN ISLAND	FR5
TUAMOTU ARCHIPELAGO	FO8
TUBUAI	FO8
TUNISIA	3V
TURKEY	TA
TURKMEN	UH9
TURKS AND CAICOS ISLANDS	VP5
TUSCAN ARCHIPELAGO	1A
TUTUILA ISLAND	KH8
TUVALU	T2
UGANDA	5X
UKRAINE	UB5,RB5
UNITED ARAB EMIRATES	A6
UNITED NATIONS-GENEVA	4U1
UNITED NATIONS-NEW YORK	4U1
UNITED NATIONS-VIENNA	4U1
UNITED STATES	W,K,N,A
URUGUAY	CX
USTICA ISLAND	IE9
UZBEK	UI8
VANUATU	YJ8
VATICAN CITY	HV3
VENEZUELA	YV,YY
VIETNAM	3W
VIRGIN ISLANDS	KP2
WAKE ISLAND	KH9,(KW6)
WALES	GW
WALLIS ISLAND	FW
WALVIS BAY	ZS9
WAYNE GREEN	W2NSD/1
WEST CAROLINE ISLAND	KC6
WEST GERMANY	DA-DP
WEST KIRIBATI	T3
WESTERN SAHARA	SØ
WESTERN SAMOA	5W1
WILLIS ISLAND	VK9
WORLD BANK	4U1
YEMEN	4W
YUGOSLAVIA	YU,YT
YUKON	VY1
ZAIRE	9O
ZAMBIA	9J
ZANZIBAR	5H1
ZIMBABWE	Z21

73 Review *by Bill Clarke WA4BLC*

Carolina Beam

It's easy to set up, and it works great!

Radio Works Inc.
P.O. Box 6159
Portsmouth VA 23703
Tel.: (804) 484–0140; Fax (804) 483–1873
Price Class: 80-10m version $100; 40-10m version $90

Several years ago, I reviewed the Carolina Windom antenna. It was an excellent antenna for general use, and I've worked considerable DX with it and its cousin, the 160 Carolina Windom. The 160 lets me operate top band, as well as all the other bands. Of course, a tuner is required for all band operation with Windom type antennas.

In keeping with a fine tradition of well-designed wire antennas, Jim Thompson W4THU has introduced another innovative version of the Windom antenna. This new version has an updated, dedicated matching unit (balun), and bent wire elements.

Installation

The Carolina Beam is about as simple to install as any antenna I have seen to date. Just take it out of the package, clip a few cable ties, and unroll everything. It is completely built and you only have to attach the feedline, tie ropes to the insulators, and pull it into the air. My time was 20 minutes from "out of the package" to "on the air."

I do recommend that the end vertical legs be weighed down to keep them from moving in the wind. A one-pound lead weight will suffice nicely.

Coax-Seal™ is provided to weatherproof cable ends. Use it!

Performance

As standards for comparison, I used my 40/80 meter double-edged sword (a single feedline dipole with legs for 40 and 80 attached at the feedpoint) at 35 feet, and a 160 Carolina Windom (over 250 feet long) at 48 feet, in drooping configuration. Both antennas have been in place for over a year, and their performance on the bands is a known quantity.

I placed the Carolina Beam at 40 feet. Using good quality coax switches, I was able to make fast changes between the antennas.

My first observation was that the Carolina Beam hears as well as it talks. When a received signal was better on the Carolina Beam, the outgoing signal was better than that from the dipole or the Windom.

- •80 meters: As good as the dipole in all cases, and about 10 dB better than the 160 Windom for local work.
- •40 meters: Same as the dipole and same as the Windom.
- •30 meters: Same as the Windom in 90% of my contacts. Remainder slightly better.
- •20 meters: 50:50, with no clear winner. This is probably due to the distinct pattern differences between the Windom and the Carolina Beam. Having both to select from made a real difference in making DX contacts.
- •17 meters: In all cases, the Carolina Beam outperformed the Windom by 5 dB or better, except for one contact that was about 5 dB below the Windom (I really cannot say why).
- •15 meters: As with 20 meters, this band was quite variable.
- •12 meters: A distinct low-angle worker. The Carolina Beam always outperformed the Windom by at least 5 dB.
- •10 meters: Same as 12 meters.

Specifications
Length of horizontal portion: 84'*
Frequency: 80–10 meters
Radiator lengths: see diagram
Feedline: 50Ω coax
Wire: #14 stranded (7 x 22), hard-drawn
Matching method: DMU and transmatch
Power rating: 1500 watts
Minimum height: 30'*
Radials: not required
*The Carolina Beam can have the 32' element reduced to only 16' by changing the location of the support rope (the attachment insulator is factory installed on all Carolina Beams). This will increase the overall length to 100', but allow a lower height. Note: I didn't try this modification during the evaluation.

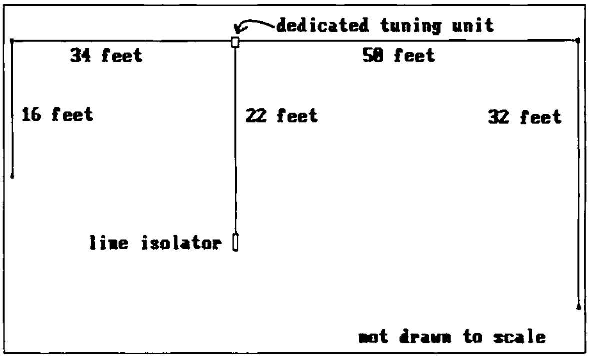

Figure 1. The Carolina Beam antenna.

It was interesting to note that there was little difference in signal reports from my station, compared to others using towers with directional beams (located near my QTH). The ionosphere is a great equalizer.

This antenna can be stretched out into a standard Windom configuration if you so desire. However, for the life of me I cannot understand why anyone would want to do it. By the way, Jim tells me the reverse is NOT true. Bending a standard Carolina Windom to look like a Carolina Beam will not result in Carolina Beam performance. The matching units are different.

How It Works

As with all Carolina Windom based antennas, the Carolina Beam is designed to create feedline radiation. This is induced by an unbalanced condition caused by the dedicated tuning unit. The feedline radiation is terminated by the line isolator to control the radiation pattern and to keep unwanted RF out of the shack. Thus, the coax feedline becomes a vertical radiator.

The horizontal portion of the antenna connects the three vertical radiators together and acts similar to a ground plane with inverted vertical elements.

Unlike trap antennas, the Carolina Beam radiates from all elements over the length of the entire structure on all bands. Because both vertical and horizontal elements are present, there is a good mixture of high and low angle radiation.

The Carolina Beam does require the use of an antenna tuner. However, most solid-state rigs require a tuner anyway to keep the SWR from shutting them down.

Pattern Plots

The radiation pattern plots accompanying this article were made

using the Carolina Beam installed at a 50-feet height over average ground. I used the ELNEC program for computer analysis, output to a Canon laser printer.

Azimuth plots are shown for the angle of elevation which gives the maximum signal (the angle is indicated at the lower right corner). Plots for the WARC bands are not included, as they nearly duplicate other nearby bands. The 75 meter azimuth plot was perfectly omnidirectional, and therefore is not included.

My Comments

I am impressed by the Carolina Beam. It is a small antenna that is able to stand up to much larger systems. The entire package is precut and ready to go in the air. It comes with a dedicated tuning unit, RF line isolator, insulators installed at all points, and a pre-made primary vertical radiator (coax).

While not really a beam in the sense that most hams envision, and not giving the directional performance that you expect from a 3-element tribander at 70 feet, the Carolina Beam is a very workable antenna. It does not cost near what a tower, beam, and rotor would.

The Carolina Beam will fit into a space just over 80 feet in length, and give full 80 meter dipole performance. This is something for the small-lot ham to think about.

The Carolina Beam is about as close to one antenna do-all as you will ever get. For those with very limited space, Radio Works produces a cut-down version of the Carolina Beam, which requires only 42 feet of horizontal space and covers all bands from 40 through 10 meters.

As well as a good choice for a home station antenna, I personally think the Carolina Beam and other Windom-type antennas, are excellent for Field Day exercises. They are certainly more convenient than towers and beams!

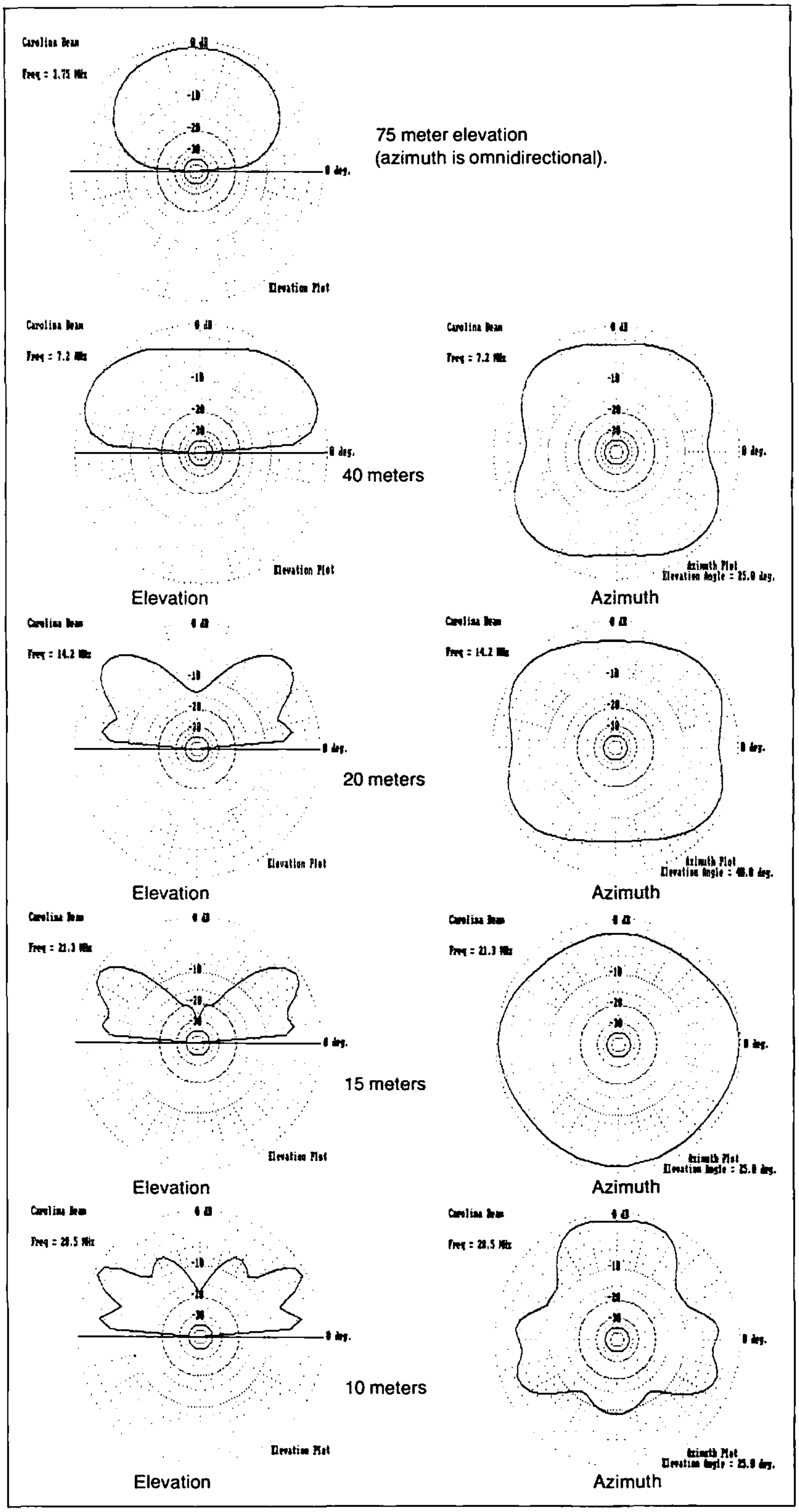

Figure 2. Elevation and Azimuth plots for the Carolina Beam.

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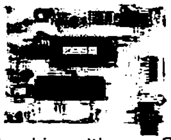

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Dual-Band Vertical

For the 160 and 1750 meter bands.

by David F. Curry WD4PLI

Using a TV push-up mast, you can get surprising ground wave radiation from small vertical antennas (30 to 50 feet high) for the 1750 and 160 meter bands. Good antenna performance is critical; the antenna must be resonant with your operating frequency for transmission, and have a good ground system.

FCC regulations state a maximum-50 foot limit in the 160 to 190 kHz bands for both the feedline and antenna. Even with strict limits such as these, transmission and reception of ground wave signals from several hundred miles away are possible at low power levels of only 1 watt.

Many amateur operators would like to try this low band, but they can't find a good design for an antenna. A 160 meter antenna could easily be matched to work the 1750 meter band, but its dimensions might exceed the legal limits. In this article, I offer a good compromise, opening opportunities for someone with space restrictions.

Antenna Description

The basic antenna assembly is in three parts: the top hat and 160 meter loading coil, the push-up mast upper and lower section, and the loading/relay system for antenna matching.

The capacity hat is the key to good radiation resistance and low angle radiation for 160 meters, and greatly improves the efficiency on 1750 meters. The size shown in the picture is 10 feet in diameter, with a wire ring around the perimeter. The wire ring further increases capacitance, adding to overall efficiency.

The telescopic portion of the antenna is a galvanized steel push-up mast you can buy at almost any Radio Shack, electronics or possibly hardware store. Select the length that suits your requirements. A 40-foot mast seems to be a good compromise of rigidity and height vs. price.

Final matching will be done at the antenna site, using a relay for dual-band operation (not required for single-band operation), and a capacitor/inductor combination.

On the 160 meter band, the antenna is current-fed by the loading inductor just under the capacity hat. The actual antenna resonance is lower than the frequency of interest, and therefore must be electrically shortened by a series capacitor at the base of the antenna. The capacitor should be preferably an air dielectric, such as a large transmitting variable from 50 to 500 pF. A vacuum variable

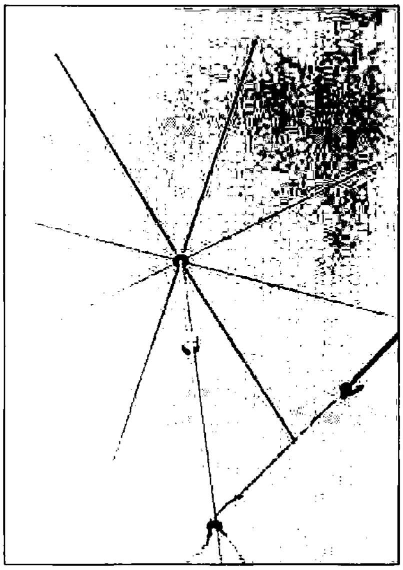

Photo. The dual-band vertical showing the capacity hat and top-loading coil.

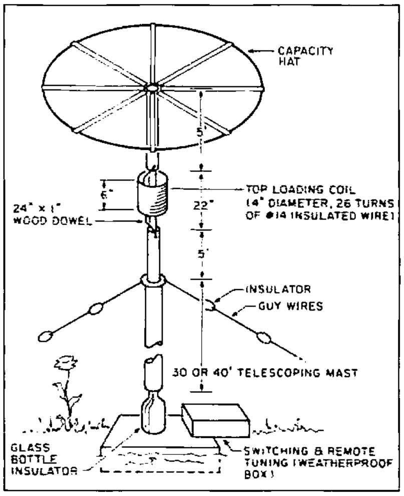

Figure 1. Overall dimensions of the dual-band vertical.

would also be ideal. The larger the tuning range of the variable, the greater the frequency swing across the 160 meter band. The capacitor connects between the antenna and the center of the coax lead, and is tuned for minimum VSWR. With the loading coil near the top of the antenna, most of the current will flow to the top, which is desired.

1750 meter operation is very different, as this antenna is extremely short at these frequencies. With the size of capacity hat described, a top-loading coil would be very inefficient due to the high amount of inductance required, and the subsequent I^2R losses from the resistance of the wire. A much larger capacity hat would be required, and would involve consulting your neighbors! Instead we will voltage-feed the antenna using a large prehistoric-size loading coil at the base, and use a tap point on the coil to match it to a low impedance source (transmitter).

By using the capacitive reactance to tune the coil to resonance as a part of the antenna capacitance, the coax actually becomes part of the antenna matching system. This offsets the 50-foot antenna and feedline restriction by turning the coax from a non-reactive transmission line to a reactive component that is part of the tuning circuitry.

The loading coil L1 in Figure 7a can be a regular air-wound inductor, with the number of turns found experimentally. Or you could use a variometer (see the sidebar) that would greatly ease the tuning procedure.

Construction

Remember before starting that the top loading coil just below the capacity hat can be eliminated if you plan to operate only on 1750 meters.

The capacity hat is made of eight aluminum tubes, each 5-feet long and ¼-inch thick, purchased at a local hardware store for about a dollar a foot (see Figure 2). At the end of each tube, press a ½-inch area flat with pliers, and drill a small hole to accommodate a

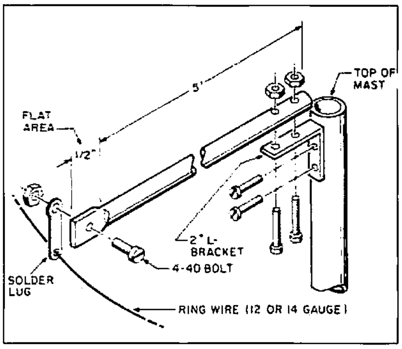

Figure 2. Construction details of the capacity hat tubes. A 2" steel L-bracket is used to attach each tube to the mast. Run a wire ring through the far ends of the tubes to form a large circle (solder the wire ring at the end of each tube).

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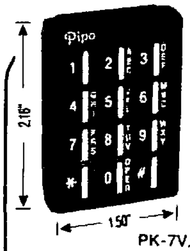

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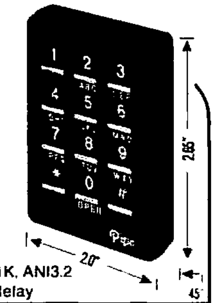

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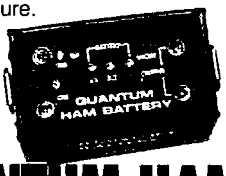

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4-40 nut and bolt. Use a solder lug so that the ring wire can be soldered securely after the solder lug is tightly fastened with the nut and bolt to the aluminum rod. This makes it easy to install the wire ring. At the other end of each tube, attach a 2-inch steel L-bracket. Drill 8 holes equidistant around the top end of the mast pipe so that the capacity hat tubes can be attached. Mount each tube to the mast as shown in Figure 2.

When you attach the top hat, be sure to twist each rod so that the solder lug at the end will be in a vertical position. The wire chosen as the ring wire should be of large solid variety, and can be insulated. String the wire through each solder lug hole, but not too tight. Clip and solder the end of the wire, and each remaining solder lug, with ample solder. Spray your favorite color of paint on the entire capacity hat assembly for weatherproofing, or paint marine varnish over all sections.

The top loading coil for 160 meters is constructed from 4-inch diameter white PVC pipe, about 5 inches long. 30 turns of #16 gauge stranded wire, Teflon™ insulated, is used for the initial inductor. You could use other coil-form material, such as Plexiglas™. Avoid black-colored PVC tubing!

Wind the coil tightly and paint it with Fiberglas resin. Use solder lugs to secure each end of the coil, and 6-inch wires to connect the coil to the top and bottom mast.

The top section of the mast is five feet of galvanized steel tubing, exactly like the top section of the telescopic vertical. The exact length is not critical since the coil can resonate to almost any reasonable length, but lengths beyond 10 feet can break due to wind resistance. Three to seven feet are recommended. *[Ed. Note: If you use a 40 or 50-foot telescoping mast for the antenna, you can cut the top 10-foot section in half to use as the top section.]*

When painting the coil, also paint a wooden dowel rod that's about one foot long and fits easily into each vertical section. The idea here is to provide good insulation and solid strength for the top section of the vertical and capacity hat. The wooden dowel works very well for this, and should be inserted into the top of the push-up mast after curing.

Final Assembly

Now you may have to make a big decision. Shall it go on the roof or in the yard?? It should be in the clear as much as possible, of course! Absorption from trees and surrounding structures can foul up an antenna of this type. Also, you have to consider a ground system after raising the antenna. Insulated radials (as many as practical) at 50-foot lengths should radiate from the antenna base in equal directions. On roof installations, use either radials, hot and cold water pipes (especially copper ones!), or chicken fence mesh. Many times a combination of these will do an adequate job, especially for the city dweller.

After you've determined the antenna site, make preparations for the insulated base. Many approaches can be used, but the old glass bottle trick works every time, and is

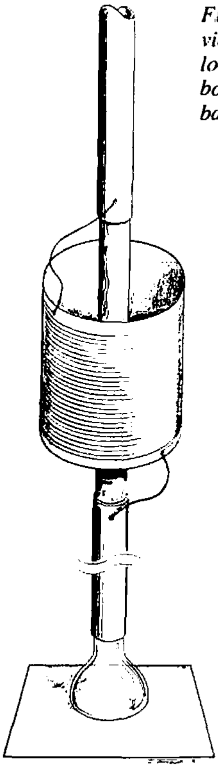


Figure 3. Close-up view of the 160m top loading coil and glass bottle insulator for the base.

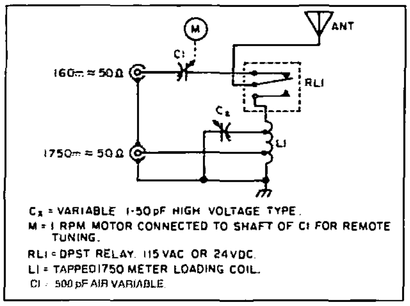


Figure 4. Switching arrangement for dual-band operation.

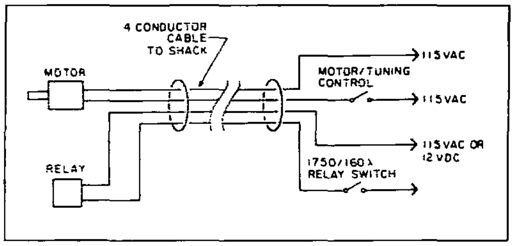
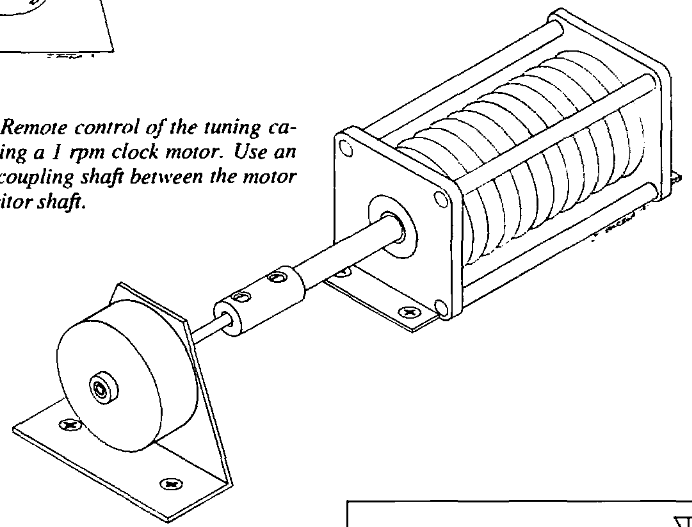


Figure 5. Cable connections for remote tuning.

Figure 6. Remote control of the tuning capacitor using a 1 rpm clock motor. Use an insulated coupling shaft between the motor and capacitor shaft.



recommended. The bottle is simply placed in cement that has been prepared and drying. Insert the bottle about four inches into the cement. The cement may be poured into a hole in the ground, for ground installations. A vent pipe can be used for roof mount, but a strong solid insulator, such as a Plexiglas or Teflon rod, must be used as an insulated support. Plastic companies usually carry this product. Alternatively, a cement block can be used with a glass bottle for roof mounts. The guy cables are ¼-inch polypropylene rope which are adequate but need replacement every couple of years.

The collapsed mast is placed over the insulator and guyed at the 10-foot section. Additional guys are attached, usually at the 30-foot section.

If steel guy wire is used, be sure to use ceramic egg insulators, two per guy to insulate the vertical. Very high voltages exist

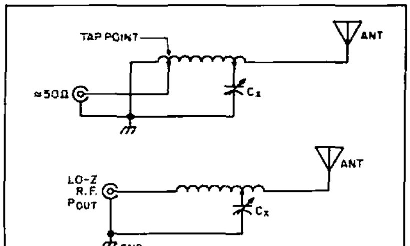


Figure 7. (a) Proper matching to 50 ohm coax. (b) Direct connection to the transmitter at the antenna site.

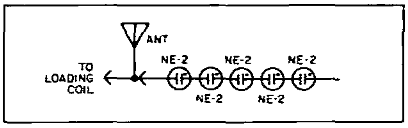
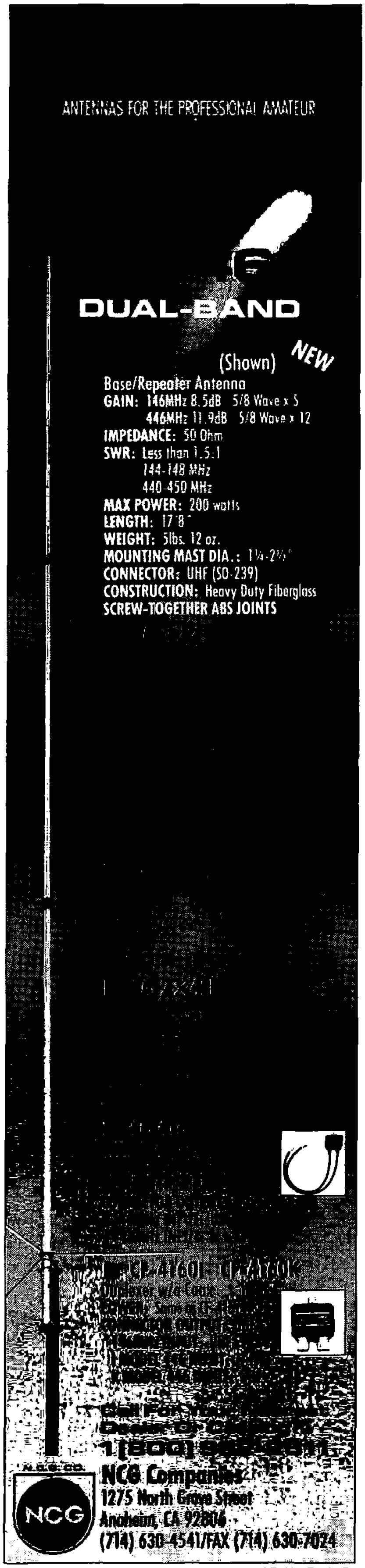


Figure 8. Neon bulbs soldered in series and connected to the antenna. When they reach maximum brilliance, the antenna is resonant.



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Variometer Construction

A variometer provides an easy way to match low frequency antennas, such as vertical radiators, random length horizontal, or "L" shaped wire antennas, and resonate these at a desired frequency.

A variometer can be thought of simply as two inductors that can slide in and out of each other. Depending on the size of the inductor coil forms, the number of turns, and the size of wire used, the inductance will vary as the magnetic fields of both coils either aid or cancel each other as the two coils are moved within each other's proximity.

One of the coils can be made small enough to rotate inside the larger coil, and the magnetic flux can be added or subtracted by rotating the inside coil. To do this, both coils must be connected in series. The variometer is wired so that the smaller rotating inductor is connected within the large outer one. Optimum efficiency will occur when both coils aid or add to each other for maximum inductance.

During initial calibration, after rotating the inside inductor to resonance, it may be beneficial to remove wire from the variometer. This is especially desirable from the standpoint of higher efficiency and better *Q*.

The whole point of the variometer is to find the ballpark resonance of your antenna system, then optimize the variometer by removing or adding turns, if required.

Assembly

First, wind the large coil form.

Usually, a range of 5–8 mH for a 30–50 foot vertical antenna will be within the 1750 meter limits. A vertical antenna such as this should also have at least a 5-foot capacity hat for improved radiation resistance. Wire gauges from 18 to 26 work well, with the small gauge wire providing more turns per inch and more inductance. Number 22 gauge wire does a fine job overall, and you'll need at least 200 feet.

Two small holes, one at each end of the coil form, is used for terminating each end of wire after winding.

Tape one end of wire with masking or Scotch™ tape to, or near, a hole at the end of the coil form. Sit in a chair or couch with the form in your lap. The spool of wire should be on the floor, leading up to the form.

Turn the form with one hand and use the other hand to guide the wire taunt against the form. A tight, even layer is required. After 20 or 30 turns you might want to stop and push the turns closer, if required.

Masking tape will hold the turns in place when you stop. In the middle of the form are two 1/4-inch holes directly opposite each other, with a small hole next to each one. Wind the turns carefully around these holes so that you don't block them, because the holes will be used later on in assembly.

A 4-40 screw with a solder lug can be installed at the end hole to terminate the wire. The insulation should be removed with fine sandpaper or a stripping chemical, and then inserted through the eye of the solder lug and twisted. Make sure that there isn't any slack that could loosen the turns of the wire. Repeat this procedure for the other end of the coil using a 4-40 screw and nut, and a solder lug terminal. If desired, a spray varnish can be used to add weatherproofing and protection. Use only a clear varnish or enamel.

Now wind the smaller coil form in a similar fashion. Because this form is so small by comparison, it may not be necessary to take the same precautions as before. The only major difference is the way the wire is installed in the form itself. (See the figure.)

At this time, varnish or spray enamel may be used to protect the inside coil.

The final step in the assembly is to install the small coil inside the larger one, and wire the two inductors together. Locate the nylon threaded rod and nylon nuts. Push the rod through one end of the large coil and screw a nut on. Turn the rod and advance the nut, then screw on another nut. After an inch or so, place the smaller coil form inside the larger one, and place the end of the rod into the 1/4-inch hole in the center of the small form. Continue to turn the rod so that it advances into the small coil form and add another two nuts on the nylon rod. Continue turning the rod so that it can go through the small coil form, and add one more nut. A total of six nuts are used, with four of them holding the smaller coil directly in the center. Tighten the nuts with FINGERS ONLY! The rod should extend completely through the large coil, with one end longer to provide a knob to turn it with. At this end, add the last nut on the outside of the large coil, and screw it so it is tight with the inside screw, centering the small coil and providing a small amount of friction so that the small coil won't slip.

Take the wires from the small coil and lead each wire through the small holes on the larger coil form.

These two wires should follow closely to the nylon rod, and have no kinks or twists.

Once fed through the small holes on the large form, clip the excess wire so that only 1/4 inch remains extending from the large coil form. Remove the enamel so that each wire is clean for soldering.

The diagram shows that the wire is first fed backwards out of the hole (A), and down the inside toward the center (B), and then outside with approximately 3–4 inches remaining. This remaining end will go through the small hole at the center of the large coil form later. With the wire at (A) and (B) installed, wind the form completely, being sure to leave an open space around the 1/4-inch holes at the end. Push tightly all turns so that the most wire possible can fit on the form. Before cutting any wire, add approximately two feet, after inserting the wire through the hole (C). Now, cut the wire and feed it through hole (C), down inside toward the center and through hole (D), to the outside.

At this point, cut the wire on the large coil, where it goes between the two 1/4-inch holes. This will be right in the middle of the coil, and will be easy to locate since it is a single wire in between the upper and lower sections.

If no varnish has been applied to the larger coil, you will need to add tape over the upper and lower sections so the turns will not become loose after you cut the wire. Each of the cut wires should be trimmed back and soldered to one of the wires from the inside coil. Snip the wires from the larger coil and solder, one on each side, to the 1/4-inch wires on each side from the small rotating coil. Allow a small amount of slack on the inside wires for rotation.

Operation

The variometer is connected between the ground systems and the antenna, usually with a tap point several turns up from the ground side that connects to the transmitter and/or receiver.

For systems involving only a receiver, simply rotate the small coil of the variometer at the frequency of interest and note a peak in reception. If there is no peak in signal strength, then it is entirely possible that resonance is occurring elsewhere. Remove turns from the top of the outer coil if required.

For transmitting purposes, remove as much wire as possible from the outer coil after the frequency has been determined and experimentation has located the variometer's point of resonance. Measure either the RF voltage across the 50 ohm load with an oscilloscope or RF voltmeter, or the RF current to the 50 ohm load. Note the value.

Monitor the radiated RF level and turn the variometer control to resonate the antenna. A receive monitor, field strength meter, or a small neon bulb placed near the antenna is useful for this. Antenna voltage can be very high. Avoid touching the antenna while tuning.

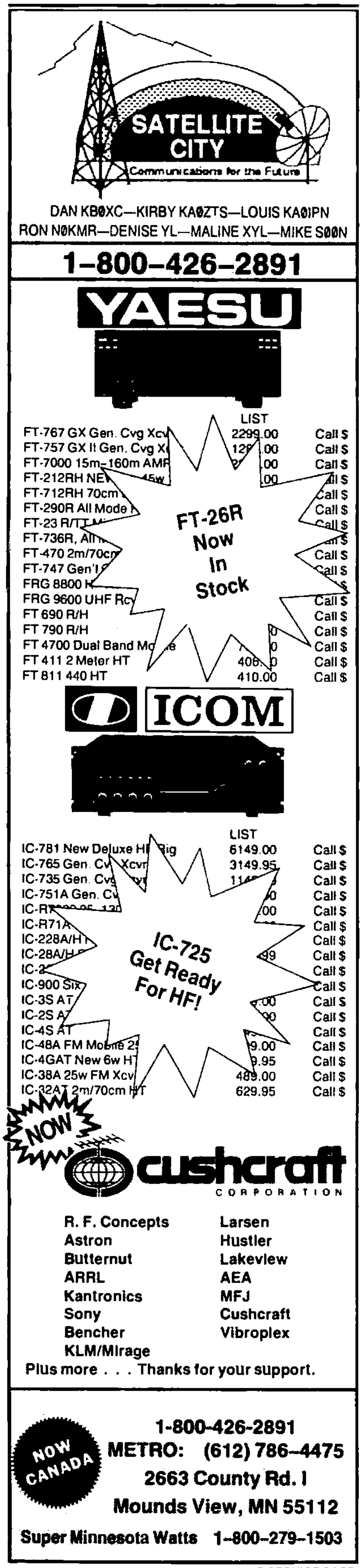
Note the current or voltage at the tap point. When the antenna is resonant, this should be the same value as that of the 50 ohm resistor. If the current is lower, go down on the tap point toward the ground end. For voltage measurements that are low, raise the tap point higher, away from ground. Re-resonate the antenna every time you change the tap point.

An optimum point will be reached where the tap point will have the same voltage and/or current, as was noted with the 50 ohm resistor, when the antenna is a resonance. Using a nonreactive 50 ohm load as a reference makes it very easy to adjust transmitters and antennas on 1750 meters.

Sophisticated equipment, such as an oscilloscope, is handy, but a small Ne-2 bulb will suffice in a pinch. Several Ne-2 bulbs soldered together in series will also work as a reference for monitoring voltage across the antenna. This is only for reference and does not indicate antenna efficiency.

Sometimes there may be difficulty in rotating the inner coil due to rubbing between the two. Adjusting the four screws that secure the inner coil will either expand or contract the coil center. Wire turns around the coil form sometimes warps the form slightly. Placing pressure will compensate for this. After this is done, set the two nuts on the outer coil form to gently hold the inner coil in the center.

A complete variometer kit is available (not including wire) for $68.95 postpaid from: Curry Communications, 852 North Lima Street, Burbank CA 91505.



CIRCLE 153 ON READER SERVICE CARD

when you use the antenna on 1750 meters, and high voltages exist on the capacity hat on both 160 and 1750 meters. You'll need a ladder next to the vertical, and rigid gloves to raise each section. Insert the wooden dowel with the top-loading coil placed about two inches above the mast.

With two small screws, bolt the coil to the side of the dowel. Clean the top of the mast in a small area. The wire from the bottom of the coil is soldered at this point. Place the top vertical and capacity hat section on the dowel rod, and clean it for soldering to the top of the loading coil. Raise the top section of the mast and tighten the section after being extended. Raise the next section and secure this after being fully extended. After all sections have been raised, check the guys and adjust the antenna into a vertical position.

You can add strength to the vertical joints by drilling ¼-inch holes through each joint and securing them with a nut and bolt through the smaller hole where the cotter pin is usually located. These masts can be quite flimsy when you're raising them. Be extra careful around power lines.

Loading Coil and Matching

Figure 4 shows remote switching and tuning of the antenna. A 1 rpm motor (M) is connected to capacitor C1 (Figure 6). Relay RL1, a power relay, will withstand at least 220 volts. This is required since high voltages exist with this type of antenna on 1750 meters. Using these will provide easy control right in the comfort of your own shack!

160 Meter Calibration

Connect an SWR meter between the transmitter and antenna. Place the transmitter into the transmit position, using low power in a clear portion of the 160 meter band that will be the frequency of interest.

Rotate the capacitor and notice the SWR meter for a dip. If no dip is indicated, try a lower or higher frequency. The top loading coil may need turns removed or added to facilitate tuning and lowest SWR. Capacitance of C1 lower than 50 pF should be avoided.

Poor ground systems will also deteriorate the lowest possible SWR. Shorting C1 will cause the antenna to resonate at its natural resonant frequency, which should be around 1750 kHz. The capacitor shortens the wavelength of the antenna into the 160 meter band, but a point of no-return can happen if the natural resonant frequency of the antenna is much lower than 1750 kHz.

1750 Meter Band Operation

Three to seven mH will be required to resonate this antenna on 1750 meters. A variometer (see the sidebar) is a convenient way to find resonance and match the antenna. Figure 7a shows proper matching to a coax, and Figure 7b can be used for direct connection to a transmitter at the antenna site. The coil in Figures 7a and b is tapped approximately five turns from the ground end, and can be found by simulating the tap point with a 50 ohm load.

Tune-Up

Transmit a signal on the desired frequency into a 50 ohm load and note either the current or voltage across to load. Replace the load with the tap point at the antenna site, and resonate the antenna by varying the inductance of the coil. Capacitor Cx is a 25 pF (value not critical) high voltage variable that is temporarily inserted to aid in finding the ballpark frequency resonance of the antenna, in case it's off-frequency. Cx should be removed or minimized for best efficiency. Adjust Cx and then add or remove turns on L1 until Cx becomes a very small value or not required at all.

Monitor the signal strength with a remote receiver or field strength meter. Figure 8 shows several neon bulbs soldered in series that are connected to the antenna. As the antenna approaches resonance, the bulbs begin to shine brighter. Once our aim, maximum brilliance, has been reached, note the current or voltage at the tap point. If there is a difference between this value and the value noted across the 50 ohm resistor, change the tap point and re-resonate the antenna. Do this procedure several times until the antenna is resonant and the SAME value is indicated at the tap point as with the value noted with the 50 ohm resistor.

This is the relative 50 ohm tap point on the loading coil, when the antenna is resonant at that specific frequency. The reactive element of the coax is absorbed by resonating the coil and antenna, providing a part of the total matching system. The direct coil method in Figure 7b can be used for beacon transmitters (for example), with the loading coil ground end connected instead to the transmitter output.

The loading coil can be made by using a large coil form, about six inches in diameter and 10 inches long, wound tightly with #18 gauge enameled wire. Plexiglas or white PVC tubing is excellent for this application. You'll have to experiment to find the exact amount of inductance required for antenna resonance. It is easy to accidentally resonant the antenna on the second harmonic. Check the signal with a receiver on both fundamental and harmonic frequencies to confirm power output on the fundamental frequency.

A car battery box (or any weatherproof enclosure) can be used to house the capacitor, relay and 1 rpm motor. The coil should be located in the clear with a coat of marine varnish after installation is complete.

Check out information on mobile 160 meter antennas for an understanding of how 1750 short verticals operate. They are very similar in principle. These short vertical antennas offer reliable results, and they're a good compromise of size vs. performance.

You may reach David F. Curry WD4PLI at 852 N. Lima Street, Burbank CA 91505. The owner of Curry Communications, David offers a variometer kit for this project for $68.95, postage paid.

The L-O-N-G Long-Wire

Helpful hints to build your own DX-buster.

by Stan Gibilisco W1GV

Many times on the air I have heard folks tell me they are using a long-wire antenna. When I hear this, I always wonder if they really do have a long-wire, or if they are just using an end-fed wire. At high frequencies, a true long-wire antenna requires some real estate. You might say that a wire is not truly "long" unless it exhibits noticeable gain and directional characteristics. Generally, this requires a length of two wavelengths or more, and at low frequencies this can be quite long!

Although it requires a lot of space, the long-wire antenna may be unobtrusive, and a good choice for the ham with a limited budget and an affinity for the lower frequency bands—20 meters and longer. This article describes the long-wire I put up, largely with the encouragement of local hams, and some hints for making things go as smoothly as possible. Murphy loves long-wire—there's so much to tangle up and snag—but he can be at least partly outsmarted. The obsessive/compulsive, hard-core antenna fanatic can win. With just one helper, I put up my 880-foot radiator despite a partly crippled right arm and wind chills considerably below zero Fahrenheit. Little things like that, and having to slither down a dangerously steep and slippery embankment, were not enough to intimidate an antenna fanatic such as myself.

Encouragement from the Net

Due to medical reasons, I had come back to Rochester to stay with my parents, whose home has great vantage points toward the north and west. A friend let me use his spare rig, an FT-101EE, and helped me put up a modest "long wire." This antenna worked well, but there was far more real estate available: an undeveloped piece of land measuring at least 800 by 800 feet (250 meters square). Why not put up a real long-wire?

But the land wasn't going to stay vacant; there was talk of it soon being bulldozed and built up. Besides, I'd be moving back out on my own in a few months. Putting up a long-wire would mean stringing 600 to 800 feet or more of wire. I was half-enthusiastic, thinking that the antenna might not last long.

But then, I thought, since when is anything permanent? One ice or wind storm can prove that no antenna is forever. If the antenna can be used for three months, that's three months more than no time. I decided not to fall for what I call "the impermanence excuse."

One friend on the local 10 meter net said he'd put up a real long-wire once, and had never regretted it; he encouraged me to go for it while I had the time and space. And so I did. Putting up an 880-foot long-wire was hard work, but it was worth it.

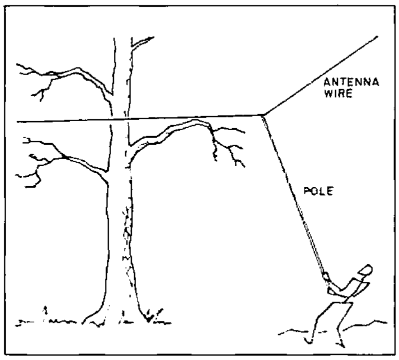


Figure 1. A long pole may be used to push the wire up higher when it is snagged on a tree.

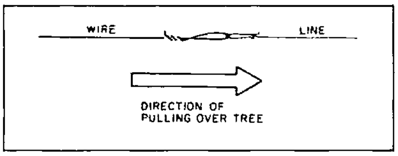


Figure 2. Attaching fishing line to the end wire with a "streamlined" knot minimizes the chance of snagging.

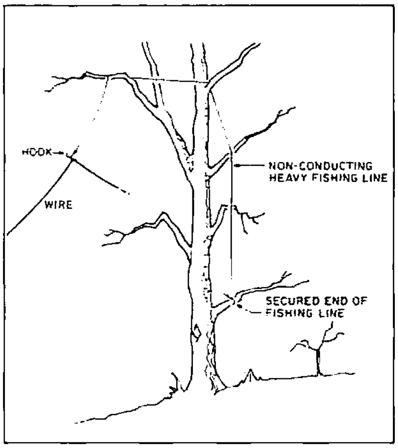


Figure 3. Raising the antenna wire as it passes near a tree may also be done if the wire gets snagged.

Snagaroo, and Other Goodies

If Murphy's laughs can be heard by madmen, there must have been a worldwide disturbance just before my first romp in the snowy, undeveloped land. The wire chosen was AWG #15 hard aluminum fence wire, available at a local farm supply store for $13.49 for a quarter of a mile (0.4 kilometer). Aluminum was chosen because it is almost as good a conductor as copper, but much lighter, and a far superior conductor to the steel wire also found in cheap abundance. As it was, steel would have been impossible to handle anyway; the stress on the wire was enough to pull me over several times.

It is truly remarkable how a twig as small and fragile as a toothpick can keep a gigantic, quivering, straining length of metal wire ground-bound against the efforts of one or even two men. If any passersby had heard my grunting and profanities on these numerous occasions, I'd have been committed straight away.

But vector physics provides a good explanation. The force of even 100 pounds of tension on a wire is nothing compared to one pound exerted laterally near the center of the span. Try pulling a long-wire as tight as you can, and then marvel at how, pushing it lightly in the middle with your little finger, you can displace it sideways several feet or meters. This principle was later used to advantage.

At first, though, I had to walk along the length of wire, free it from innumerable snags on bushes and small trees, pull the wire tight again, then trek along under it in the snow, tripping over small irregularities in the terrain and going down—poof—into the powder like a stuffed doll, muttering as I spit out snow and twigs. By this time it was too cold for loud swearing.

When the wire got caught in a branch too high to reach, I used a pole to push it up (Figure 1). The technique for very tall trees was to throw a line over the whole tree, or shoot it over with a bow and arrow—first watching out for kids playing or grownups hiking—and pull it up with a miniature grappling hook attached to the other end of the line.

Problems and Lessons

Using the bow and arrow method, we anchored the wire at its destination up over a tree. Here, Murphy had another golden opportunity to have some fun. Some problems that occurred were:

1. The wire snapped. I don't know how solid #15 gauge aluminum wire could break from less stress than my own body weight—140 pounds in full winter gear—but it did, somewhere up in the tree (of course), so that another weighted arrow had to be shot, the

MY GAP CHALLENGER DX-VI

Lew McCoy, W1ICP
CQ Technical Editor
(March 90 Review)

..."could actually hear signals that were in the noise on the beam. In my comparisons between the base-fed vertical and the GAP, the GAP consistently outperformed the base-fed antenna. Most of my reports were approximately one s-unit better with the GAP. One other surprise was that the GAP vertical was quieter (less noise) than the two base-fed verticals. I would rate the GAP as a quality product, but even more important a good performer."

Richard Morrow, K5CNF
73 Magazine
(October 90 Review)

"another very good thing about the GAP antenna is that you don't have to tune it. Usually broadband antennas are not very efficient, but this one is. If I could have only one antenna, I would definitely rather have this one. The lack of lossy coils, and the coverage of a very wide part of 75 meters by an all band vertical, impressed me more than a little!"

Kurt N. Sterba
Worldradio Magazine
(February 91 Review)

"These guys have solved a problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. How does it perform? Like a hot knife through butter. I was just a barefoot boy answering the CQ callers. They just kept coming back to me. POW! POW! POW! I am almost struck with disbelief myself. I mean, this is a vertical. But then, it's a vertical with a big difference. I was indeed pleased. If I were a whole lot younger and I had two of those GAPs phased, I'd tell those contest hotshots to . . . look out!"

CIRCLE 172 ON READER SERVICE CARD

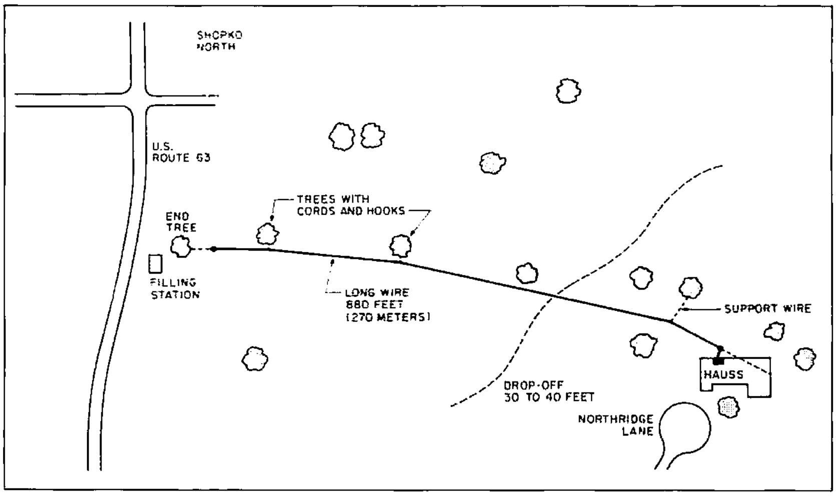


Figure 4. Map of long-wire antenna at W1GV. The wire runs in almost a straight line, an important feature for obtaining the characteristic directional pattern.

whole end insulator redone, and the wire pulled up again. *Lesson: Don't think that a wire won't snap.*

2. The wind blew the arrow off-course. Thus it did not catch the line in the highest part of the tree. *Lesson: Work when there isn't much wind (10 miles per hour or less).*

3. The arrow didn't have enough weight on it. It wouldn't come down where we wanted it to, or it wouldn't come down at all. *Lesson: Put enough weight on the tip of the arrow (a large stove bolt or two) so that the arrow will reach the ground.*

4. The fishing line or twine came off the arrow as it was fired. *Lesson: Secure the line to the arrow, and be sure the line is strong enough to take the initial tensile surge as the arrow is fired.*

5. The arrow was lost or got stuck out of reach. *Lesson: Bring two or three weighted arrows.*

6. The fishing line snagged on a twig with one ounce tensile strength, preventing a heavy, 50 mph arrow from even leaving the vicinity of the firing point. The arrow rebounded and struck the shooter in the face. *Lesson: Avoid snags and wear safety goggles.*

7. The end wire, or rope, snagged in the tree as it was being pulled over. This probable event should be anticipated. *Lesson: Tie a knot that is "streamlined" to reduce the snagging tendency (see Figure 2).*

8. The span was simply too long. At first I had planned to run a 1,000-foot (305-meter) single span of wire. I thought that the light weight of aluminum would make this possible, but the sag and tension were simply too great. *Lesson: Don't go for a single span; provide for intermediate supports.*

After all these lessons, the entire wire, including the lead-in, was finally up, with not a single splice. There were no joints to become corroded. It is very difficult to solder aluminum wire, so this was important.

Intermediate Supports

The wire ran near two large trees, and was snagged on a third one about 20 feet (6 meters) above the ground. The intermediate trees could have been used as supports by shooting weighted arrows over them, then pulling the entire long-wire through, but I was worried about tangling or kinking the wire. However, we figured out how to use these two trees for support, and unsnagged the wire from the third tree.

First, a weighted arrow was shot over the tree, using heavy braided 20-pound test line. Then a No. 4 fishing hook, the triple kind like a miniature grappling hook, was attached to the near end of the line, or the end that also was on the same side of the tree as the wire (Figure 3). The other end of the line was pulled until the hook caught on the wire, which it would *have* to do, having three barbs at 120 degrees apart. The wire was raised gently until the tension was deemed sufficient or the wire was high enough, then the line was secured to the bottom of the tree around a limb about an inch (2.5 centimeters) in diameter.

This technique allows for the wire to slide when the wind blows. It's not the strongest, most durable arrangement, but if it fails, the whole antenna won't come down. When dealing with an 880-foot long-wire, we must expect that eventually part or all of it will have to be restrung.

Finally the wire was connected to the transmatch and the grounding system was installed.

Grounding: DC and RF

Fortunately there was a cold-water pipe, copper with soldered joints, running through the wall right behind the rig. It seemed as though Murphy had slipped. It was difficult to believe this was possible, and my skepticism proved well justified. Oh, the pipe was there, all right, and was grounded for DC, as was evidenced by the shock I got when I made the mistake of touching it at the same time as touching the wire from the chassis of the radio, with the radio plugged in. As I breathed deeply and checked my pulse to make sure my heart was still beating, I recalled the old saying, "Never touch two grounds at the same time."

What smart-alec plumber put the RF choke in the pipeline? The ground did not work well at all for RF. On 40 meters, whenever the key was down, the receiver protection lamp lit up bright white on the back of the FT-101EE, and on 15 meters there was RF all over the house: The intercom picked up monkey chatter on SSB.

Any end-fed wire is bound to present problems of this kind. First, since the radiating part of the antenna comes right down to the station, there will inevitably be at least some "RF in the shack," even with a perfect grounding system. Second, the system is inherently unbalanced, and this makes a good ground mandatory. There are various ways to make the ground good, or at least fair, for RF. All of these techniques involve using resonant wires for each band to be used.

I installed quarter-wave, free-end wires for 10, 20, 40, 80 and 160 meters. The 40 meter wire worked as a 3/4-wave wire at 15 meters. The shorter wires were simply cut to the lengths as measured: about 8 feet for 28 MHz, 16 feet for 20 meters, 32 feet 8 inches for 7 and 21 MHz, 66 feet (20.1 meters) for 3.5 MHz CW, and 130 feet for 1.8 MHz near the bottom of the band.

The 160 meter wire was trimmed by tuning into it and pruning for minimum SWR at 1.810 MHz, the center of the desired operating range of 1.800–1.820 MHz. Surprisingly I had to trim about 7 feet from the wire to get minimum SWR at 1.810 MHz.

The ground wires were strung as straight as possible. This would, it was thought, enhance their performance as RF grounds, by maximizing the efficiency with which they would radiate the RF in the shack away. All these wires were tied together at the station and connected to the ground terminal on my MFJ-989B "Super Tuner V."

There was no evidence of any RF on my HF rig after the ground wires were installed. However, using a linear amplifier, some lighting of the receiver protection lamp was still evident on 160 and 80 meters.

Since I rarely use the amplifier, and in fact was only borrowing it for an upcoming 160 meter contest, I left the antenna perfection phase, and began the real acid test of finding out how well the long-wire would perform. I hoped for the best from a straight wire that measured 13 wavelengths at 20 meters, and 6.5 wavelengths at 40 meters, and was up 50 feet high. The wire was almost perfectly straight except for the lead-in, and I surmised that the major lobes would give a gain of about 9 dB on 20 meters and 5 dB on 40 meters. These determinations were made based on information in *The ARRL Antenna Book* (13th edition, page 165) and the *Radio Handbook* (22nd edition, p. 28.3, Howard W. Sams & Co.).

On The Air

The antenna runs west-northwest by east-southeast, or at azimuth 300 degrees from the house (Figure 4). Major lobes will be expected to run roughly at azimuth 285–315 degrees and 105–135 degrees on 14 MHz, with secondary lobes making these regions broader and closer in off the ends of the wire. On 7 MHz I would expect similar performance, with somewhat broader lobes. I was especially interested in VK6 and the Indonesia chain at 7 MHz, which I would listen for in the mornings.

The loudness of the VE7 stations was the first thing I noticed. One of them was even louder than a friend two miles away on a line of sight at 14 MHz. In fact, this VE7 is to date the loudest signal I have ever received on this radio, *bar none* (even the calibrator). He tipped the meter at S9 plus 37 dB, and while I do not regard most S-meters as absolute, this level qualifies as "S9" by anybody's standards. I worked several VE7 and VE6 stations, as well as loud W7s (who always seemed to be in Washington State), to verify that this antenna could radiate as well as receive in that direction.

Signals were also strong to and from W2 and W3-land, and southern New England, with W1AW code practice often as strong as the locals, both on 14 MHz and on 7 MHz. I rarely could hear any signals from Europe, although Africa was easy to get. The theoretical directional properties of an unterminated long-wire were being confirmed.

I have worked many stations now on 160 through 20 meters with this antenna. While it is a good performer and very inexpensive, all good things must end. The large tract of land on which the antenna resides is scheduled for development soon. More than anything, an antenna like this is a good conversation piece. It *sounds* awesome to say, "Rig HR 90 W output to 880 FT long-wire pointed right at U." The wire is almost invisible, and creates no eyesore. I use a grounding switch outside the window when the antenna is not in use; a long-wire picks up substantial static electricity and induced voltages from utility lines. If it happens to come down, I'll just put it back up again, maybe in a different direction just for fun. It would be possible to put up several different long-wires and switch them for work in various directions, and I probably would do it, too, if the property were going to be available longer—and if I were going to stay longer.

Conclusion

I thank the members of the local radio club who helped me with this project in cold weather. I am also grateful for their interest in the project and their putting up with my seemingly endless chatter about antenna theory on the local 10 meter SSB net.

If there is room for a true long-wire antenna, I'd say it is a good investment of time and money and effort to string one up and get on the air with it—for fun, if for no other reason. 73

You may contact Stan Gibilisco W1GV at 340 Cedar St., St. Paul MN 55101. Please enclose an SASE.

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GGTE Morse Tutor Software
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(The Radio Place, Sacramento, CA)
MFJ Prize Package
204B Antenna Bridge
1701 6-Position Antenna Switch
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HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
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Webersat Success

The microsat with the photographic penthouse, Weber-OSCAR-18, has been featured before in this column. Now it's time for an update. Recent pictures from the satellite of the earth, sun and moon are showing a definition and quality the designers only hoped for years ago.

Launched in January 1990 with three other microsats and two UoSATs from England, Webersat, as it's called at Weber State University in Ogden, Utah, is the second project undertaken by the Center for Aerospace Technology (CAST) at Weber State. The first was NUSAT 1 (Northern Utah Satellite 1), launched by the *Space Shuttle Challenger* in 1985. CAST continued with ambitious programs and teamed up with AMSAT to work on the microsats.

Webersat weighs 27 pounds. Its dimensions are 9" x 9" x 12.5". The unusual 12.5-inch height on one side is due to the camera and student-created experiments encased in the upper unit Most of the satellite is covered with solar panels. Within the satellite are six vertically stacked sections that communicate through a Local Area Network (LAN) bus. The lower five sections contain two 70 cm transmitters, a five-channel 2 meter receiver, the battery system and charge regulator, and a flight computer and digitizer system with logic support circuitry.

The uppermost module carries the color camera, a spectrometer, an L-band TV receiver, an impact sensor, a horizon detector, a command and control unit, a magnetometer, an FM modulator for low speed video transmission or synthesized voice with beacon messages, and an array of sensors for temperature, voltage, current and light intensity measurements.

While the scientific experiments on Webersat have been extremely useful for educational studies by schools around the world, the imaging and download system have been the highlight for amateur radio operators. The satellite takes pictures of the earth, or another celestial view, and transmits the image via phase-shift keyed AX.25 packets.

The camera is a modified Canon CI-10 CCD (charge-coupled device) unit with a 25mm lens using either programmable or automatic iris. When aimed at the earth, the camera sees an area 130 by 170 miles. The digitizer processes the video from the camera, then sends the image data to memory for downloading via the packet transmission system. Up to 12 pictures can be stored in the two-megabyte memory. Each image can be as large as 166,000 pixels (individual picture elements or dots on the screen). While the data can be downloaded to the earth via the FM modulator, it is usually sent by the packet radio system.

Hardware and Software

To receive the images, a station must have a PSK demodulator hooked to a Terminal Node Controller (TNC) and a computer capable of receiving the data and storing it. For those already on packet, the move requires a PSK modem and a 70 cm sideband receiver with input lines (microphone up/down buttons) allowing digital frequency control. Modems are available from PacComm, the Tucson Amateur Packet Radio Corporation (TAPR), Radiokit, L.L. Grace, and Advanced Electronic Applications (AEA).

Although directional antennas will help collect more picture data on each pass, they are not absolutely necessary if a good GaAsFET preamp is available with an omnidirectional home-station antenna. Antennas currently in use for local FM operation should be tried before purchasing or building a larger or more complex system. The primary downlink frequency is 437.102 MHz and the secondary is 437.075 MHz.

A PC compatible computer with EGA or VGA graphics, along with appropriate software, is required to collect the picture data. First, put the terminal node controller (TNC) in the KISS mode with the command KISS ON followed by RESTART. Use a data collection program like TLMDC version 3 (available as free software on many BBSs) and follow the instructions included with the program. Normal data and messages will be displayed on the screen during a pass while the raw picture data is stored in a file.

WEBERWARE 1.1 from Weber State University, available from AMSAT for $30.00, decodes the raw picture files and merges data. It takes at least two passes to get a complete picture, since even picture lines are sent on the first orbit, and odd lines are sent on the next. Work has begun on a new version of WEBERWARE, but it may be as long as a year before it becomes available.

Other individuals have produced ex

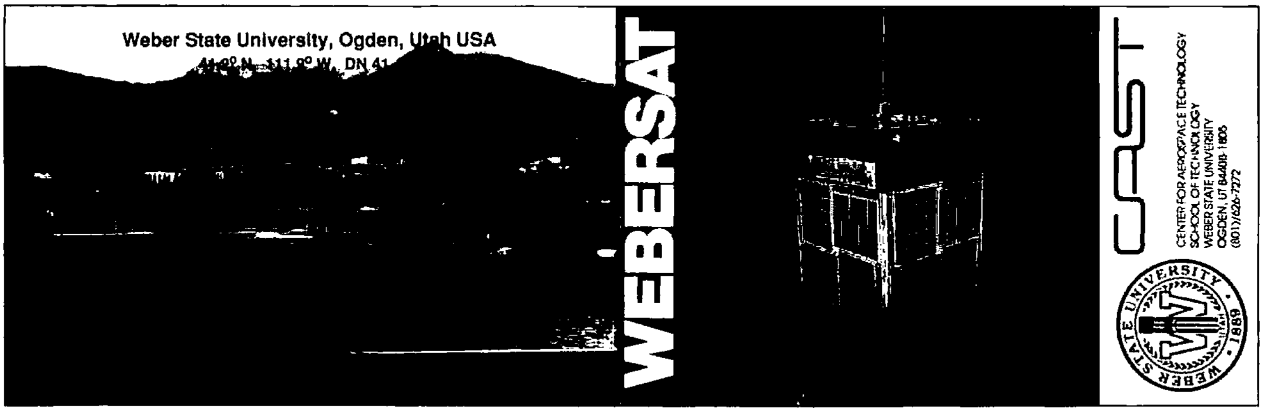

Photo A. QSL card (opened, front and back) from Weber State University for reception of telemetry from Weber-OSCAR-18.

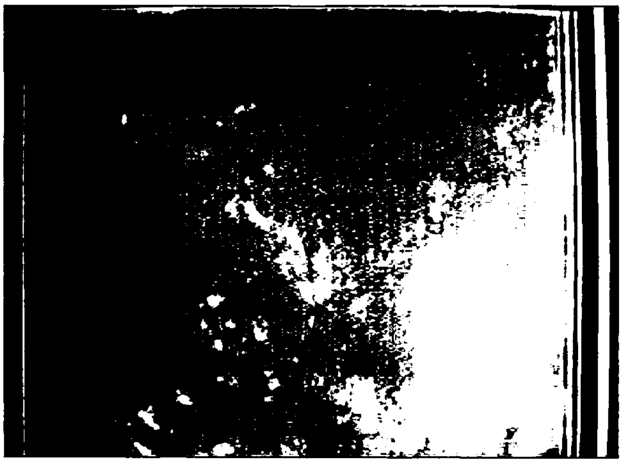

Photo B. Wispy cloud formations seen by W-O-18 on August 18, 1990.

Photo C. View over Sumatra taken on April 14, 1991 by W-O-18 at 0433 UTC.

perimental software to provide the maximum resolution available from the Webersat imaging system. The photos show super-VGA images created using a very early version of WEB1 by Franklin Antonio, author of the very popular Instant Track satellite tracking software. The program only works with high-resolution systems and currently requires picture data previously merged and filled in by Weberware to get finished pictures. Plans are underway to begin beta testing of WEB1 sometime before the end of the year.

Before Webersat was launched, many pictures were taken, stored, and transmitted from the satellite. These pictures were of buildings and scenes around the Weber State campus. When viewed with either WEBERWARE or WEB1, the pictures show very good detail and contrast. Many of the early shots from space did not. They appeared grainy with bad exposure and contrast. Many hams lost interest in the picture packets from space.

Attaining New Heights

On August 15, 1990 the controllers at Weber State successfully took a picture of the sun. (A WEBERWARE version of the image was presented in the December 1990 "Hamsats" column.) Within a month, better earth views were also being taken.

In March, the controllers began shooting pictures in the dark, and caught the moon. The camera specifications did not indicate that this would work, but it did. Although it is difficult to see, the moon appeared as a crescent in the upper right-hand corner of the photo (not shown) that I was able to take from the monitor screen.

The earth view of April 14, shown in Photo C, is an example of some of the earth views currently downloading from Webersat. The resolution looks more like a commercial weather satellite, rather than a $10,000 amateur device built by students.

Unlike commercial satellites, views of other parts of the sky are possible with W-O-18, and experiments to try new ideas with the imaging equipment are encouraged. Weber State began testing systems in June for possible imaging experiments in July during the solar eclipse. All the onboard memory was used to collect image data in hopes of catching views of the sun and earth during the eclipse.

More experiments are expected from the team at Weber State, and further software developments are hoped for. More information on W-O-18 is available in a recently released manual created by CAST and sold through AMSAT. Although the manual doesn't have the data necessary to write picture processing programs, it does provide plenty of general data on the satellite and its many experiments and capabilities. Call AMSAT at (301) 589-6062, or write P.O. Box 27, Washington, DC 20044 for more details. ■

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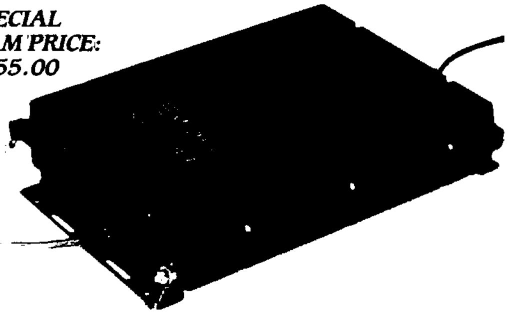

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TM-2530A	2M 25W DELUXE	499.95	CALL
TM-2550A	2M 45W DELUXE	519.95	CALL
TM-331A	220MHZ 25W PROG MIC	469.95	CALL
TM-441A	440MHZ 25W PROG MIC	479.95	CALL
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TM-731A	2M/440MHZ DUAL BAND	749.95	CALL
TM-941	2M/440M/1.2 TRI-BAND	1199.95	CALL
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TM-851A	70CM 25W ALL-MODE	771.95	CALL
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IC-4SAT	70CM 2-5W MICRO	449.00	CALL
IC-4GAT	70CM 7W 15MEM DTMF	449.00	CALL
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IC-3220A	2M/70CM 25W 40MEM	659.00	CALL
IC-3220H	2M/70CM 45W 40MEM	699.00	CALL
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FT-4700RH	2M/70CM REMOTE HEAD	799.00	CALL
FT-736R	2M/70CM 220/1.2 SAT	1922.00	CALL
FT-5200	2M/70CM DUAL BAND	749.00	CALL
FT-6200	70CM/1.2 DUAL BAND	899.00	CALL
FT-2400H	2M 50W LCD,CTCSS	419.00	CALL

HF EQUIPMENT

MODEL	DESCRIPTION	LIST	OURS
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Parts!

Selecting them, finding them, buying them, substituting them, even recognizing them—parts are where it's at! Equipment is, after all, just a collection of components, all wired together to achieve an end. Sometimes, however, parts can be a big pain in the dummy load, because they may be hard to find, or their markings may be cryptic or nonexistent. Let's take a look at managing parts problems.

Although some repair jobs can be accomplished without new parts, many cannot. If you have or can easily get what you need, great. But real life seldom works like that, especially in electronics. When you need a new component and can't get it, the first thing to consider is the original part's function. Was it part of a critical circuit like a balanced mixer? Or was it a simple DC AGC amp, or perhaps a switching circuit? Once you know what is called for, you can make some intelligent decisions regarding a reasonable substitute. The process varies according to the type of part required, so let's look at a few:

Resistors, Resistors

If the original resistor was a standard 5 percent type, the circuit probably was not too critical, and any standard resistor of the same value (or nearly so, if you must wire multiple resistors together to get one close), and the same or greater wattage rating, should work. Of course, be sure to fix whatever malfunction was pulling too much current through the old resistor before inserting the new one, or you'll just fry that one, too. Resistors do not burn up on their own—something else takes them out.

Never use a wire-wound power resistor when the old one was a composition type. Wire-wounds are basically coils, and they do have significant inductance. Even in DC power supplies (especially switching supplies or switching regulators), they can wreak havoc. Of course, if the original part was wire-wound, then it's OK to use the same type. Usually, you can substitute a composition resistor for a wire-wound (as long as the new part can handle the power dissipation), but there are odd exceptions in which the designer used the inductance of the wire-wound resistor, or at least compensated for it elsewhere. If you're not sure, just replace the resistor with the same type and all should be fine.

If the original resistor was a high precision type, you must replace it with another high precision resistor. Those things cost extra (although not a great deal), so manufacturers use them only when necessary. You can be sure that circuit performance will be significantly affected by an out-of-tolerance part. For that matter, some circuits may require realignment even if you use the correct part.

Note that even if you find a standard 5 percent unit that measures within the tolerance of the high precision part, don't use it. The drift and thermal characteristics are looser on the standard part, and it may drift out of tolerance over time. Precision resistors are available at many mail-order outfits, and they don't cost a lot anyway.

Can You Read Me?

How can you tell if a resistor is high precision or not? If it has four color bands and the last one is gold or silver, then it is a standard 5 percent part. If it has five color bands, then it is a 1 percent part. On these, the value is represented in the same way as for standard parts, except that one more digit is specified. For example, a 1k ohm 5 percent resistor reads brown, black, red, gold. That's 1, 0, 00 and gold for the tolerance. A 1k ohm 1-percent part would read brown, black, black, brown, brown. That's 1, 0, 0, one zero and brown for the tolerance. It sounds hard but, once you get used to it, it's not much different from reading standard parts.

By the way, the standard resistor tolerance back in the tube days was 20 percent! Those resistors had no tolerance marking, so they only had three color bands. Then came 10-percent parts, which had a silver band. In modern gear, though, I doubt you'll see anything looser than the gold-banded, 5 percent units. Naturally, it's fine to replace a looser-tolerance part with a better one.

Let's Cap It

Capacitor substitution is much more complicated. Caps come in many forms, and each one has its own characteristics. As with resistors, first determine the function of the original part. If it was a simple bypass cap, darn near anything will work fine as long as the value is in the ballpark and the voltage rating is as high or higher than the original's. Same goes for coupling caps between audio stages. If, however, the cap was in a tuned circuit, you had better use the right part or a better one.

Caps come in many flavors. There are ceramic, polyester, polystyrene, polyethylene, mica, metalized film, metalized polyester, tantalum, aluminum, paper, and a few more which slip my mind at the moment. And within each group, there are subgroups. Ceramics, for instance, may be NPØ, which means "negative/positive zero." This refers to the drift with temperature, and specifies that the cap will neither increase nor decrease its capacitance value as it warms or cools. NPØs are most commonly found in tuned circuits, as they are overkill in bypass and coupling applications.

If a similar-looking ceramic cap says "Z5U," "N750," or some other number in addition to its value, don't use it to replace an NPØ; drift will result. In most cases, it is safe to replace a lesser-quality cap with an NPØ, but even this is not always true. I have seen occasions where a cap with a specific thermal drift characteristic was used to compensate for other parts' drift in the opposite direction! To be safe, in a tuned circuit always use the same type cap as the original.

Plastic caps of the "poly" variety are very stable, and their true values fall quite close to their stated ones. It can be hard to tell which variety you're looking at, because most of them look the same—like a small, rectangular green case with two leads sticking out the bottom. Generally, the size is a giveaway; if you can get the same value in the same size, it is probably the same type! Luckily, most circuits are not critical enough to care which kind you use, but there are exceptions. If in doubt, try it—you won't blow anything up. The worst that might happen is some drift or substandard performance, which you can remedy with another cap.

Tantalum caps are quite common these days because they offer lots of capacitance in a very small package. They're used in power supply, audio and coupling applications. In my experience, they are quite prone to shorting out. If you find a bad one, be sure to replace it with another tantalum part. Because of the high capacitance values, your only other choice would be an aluminum electrolytic, and those have much looser specs than tantalums.

Like normal aluminum caps, tantalums are marked with + and - and are polarity sensitive; be sure to put the new one in the right way around! If you install one backwards and apply power, discard it and use another, even if it still seems to work. Tantalums just won't stand reverse polarity, even for a second, and that reversed cap will fail in short order.

Aluminum electrolytics are those largish cans you always find near power supplies and in audio stages. They are pretty failure-prone, but they are easy to get. Normally, they are polarity sensitive and, like tantalums, are marked with + and -. There's an exception, though. Non-polarized aluminum caps are used in AC applications like hi-fi speaker crossover networks, and they cannot be replaced with normal electrolytics because the alternating polarity will destroy a polarized part.

Non-polar caps are usually marked "NP," and they never have + and - on them. They're a bit harder to find but, should you need one, you usually have no choice because no other type of cap has high enough capacitance without being polarized. If the NP cap is of fairly small value, you may be able to get away with using other non-polar types. For instance, I recently replaced a 3.9 µF non-polar cap in the horizontal sweep section of a computer monitor with four 1 µF polyester caps wired in parallel. The voltage rating of the new caps was high enough, so I tried it and it worked fine.

Speaking of voltage ratings, always remember that you must *never* replace an electrolytic cap of any kind with one that has a lower voltage rating. Manufacturers typically use parts with ratings 50 to 100 percent higher than the intended applied voltage. Use of a lower-rated component is likely to result in premature failure, and use of one with a rating lower than the actual applied voltage will quickly result in smoke!

It Gets Crazier

Substituting semiconductors gets really wild, because there are so many kinds. Diodes, transistors, FETs, MOSFETs, linear ICs, digital ICs, TTL, LSTTL, CMOS . . . there's just no end to the variety of what you might find in today's rigs.

In years gone by, manufacturers were forced to make their gear from "off the shelf" parts, which made it easy to find replacements. The increasing complexity of today's rigs, combined with the Japanese financial structure's willingness to commit to special purpose parts (a key element of that country's tremendous success), has created a trend of custom components.

You just can't build a camcorder or a 3 x 5-inch computer-controlled walkie from off-the-shelf components! Especially in the digital sections, manufacturer- and even model-specific chips are the rule.

Chipping Away at It

Luckily, those custom ICs rarely go bad. I have seen blown microprocessors (lightning cases) only a few times in my entire electronics career. If you do have a bad custom chip, you must go to the manufacturer for a new one. Even in the case where, say, a Matsushita or NEC microprocessor was used in another maker's product, that seemingly "standard" part probably has a suffix on its part number, which indicates that it has some specific ROM code built into it. Another "identical" part, but with a different suffix, won't work.

Sometimes, chips which may at first glance appear to be custom really aren't. Many standard ICs, with standard part numbers, are disguised by extra numbers and letters tacked onto the "standard" designator. The extra characters are used to identify the specific maker, case style, temperature range, etc. For instance, a D4011BC, a CD4011BCN and an MN4011B are all the same part, in this case a 4011 CMOS quad NAND gate worth about 25 cents. But if you order that part from the rig's manufacturer, you'll probably pay 10 to 100 times its true value and wait quite a while to get it!

The only way to recognize the standard designators hidden in part numbers is to become familiar with the generic numbers used for different families of ICs. For instance, standard "low-speed" CMOS parts use the 4XXX code, while low-power Schottky TTL is specified by 74LSXXX.

We'll continue this next month, and wrap it up with the names and addresses of as many of the major parts sources as I can find. See you then! ■

ATV

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
Forest Road
Hancock NH 03449

DARA Balloon

When launching ATV balloon experiments, the careful choice of a launchsite has a direct bearing on your success. The Dayton Amateur Radio Association (DARA) found the ideal location to fly their ATV balloon experiment: an actual weather bureau radiosonde installation just northeast of Dayton!

Permission was granted to use the facility after the morning radiosonde launch. Two radiosonde balloon flights are made each day (7 a.m. and 7 p.m. EDT) from the Huber Heights location (see Figure 3 on p. 31 of the August '90 issue of *73* for a map of U.S. radiosonde sites). The radiosonde transmits a series of telemetry tones on 1680 MHz which are decoded at the ground station computer (altitude, temperature and humidity). An 8-foot dish in a radome on top of the inflation building (see Photo A) tracks the balloon during its flight to indicate azimuth and elevation to within 0.01 degree accuracy. The ground computer uses this data to calculate wind direction and velocity at various altitudes which are used for pilot winds aloft forecasts. Those of you with a receiver that tunes this frequency in wide-band FM mode can listen in to these signals (the ICOM R-7000 and the ACE AOR-3000 has been used successfully).

Liftoff

Tom White, who works at the facility, launched the radiosonde at 7 a.m. as the DARA group was setting up for their flight. Tom's advice and help during the DARA flight was invaluable (he's launched well over a thousand weather balloons in his career!).

As the radiosonde was parachuting back down, the DARA group assembled their ground station and started filling up their balloon. Usually just the significant levels of radiosonde wind data are available at the FAA. Since we were at the actual site, all of the data was available so we could crunch it through the BALLTRAK tracking program. As a result, the computer prediction came within 300 yards of the actual touchdown!

Everything was on schedule for an on-time liftoff. The balloon was nearly inflated and the payload was ready. It looked like a picture perfect liftoff was in the making. As Dave Pelaez AH2AR/8 was inflating the balloon, he paused to smile for the cameras. His smile quickly changed to a frown, when a large POP was heard! The balloon had burst due to a flaw and flopped down on the table in a useless pile of rubber.

Fortunately, another balloon materialized and there was just enough helium (with a hydrogen assist) to fill another one. Although this balloon looked very distorted with a clear bubble on top, it survived liftoff and flew to over 86,000 feet.

Photo A. The DARA group inflates their first balloon in front of the radiosonde launch facility in Huber Heights, Ohio.

The Payload

The video section of the payload consisted of a Uniden VM-100 TV camera, a P.C. Electronics KPA5-RC 1 watt transmitter and a High-Technology Flight telemetry computer board with video overlay display (on-screen display of the W8BI callsign, temperature and altitude). A Hamtronics TA-51 two meter FM transmitter (modified for 100 mW output) sent out a digitized voice message on 144.34 MHz (Rainbow Products voice digitizer). In addition, a 1-watt CW transmitter (Ramsey QRP-20 with a GLB-2 CW ID) on 20 meters (14.035 MHz) sent out a message to the world. Since the Indianapolis Foxhunters were chasing down this package, I decided the recovery chances were good, so I risked my 35mm film camera which we piggy-backed on the side of the payload (it has now survived three trips to the edge of space!).

Photo B. The W8BI balloon ready for liftoff

The Flight

Great views of the suburbs of Dayton were seen via the downlinked video for the first few minutes. Since it was a hazy and fairly cloudy day, very little could be seen except for the telemetry overlay after the balloon passed through several cloud layers. Occasional views of the horizon were seen near the top of the flight.

Snow-free video was seen out to over 200 miles away. The 2 meter and ATV signals covered a good deal of the Midwest (a 400-mile plus range) at peak altitude (from Niagara Falls, Ontario to Iowa).

Touchdown

The upper level winds were very light. The weather bureau radiosonde travelled just 11 miles and landed very near the skycrapers in downtown Dayton. This had us a little worried (nothing like recovering a payload dangling from the top of a 50-story building!) Fortunately, the DARA balloon didn't go up as high as the radiosonde and parachuted down just east of the city in the open countryside. The Indianapolis foxhunt team kept under the balloon throughout its journey. Veteran balloon hunter Larry Oaks WB9YAJ told us his secret: "I just charge directly at the balloon at all times during its flight." This technique apparently paid off. Spectacular views of the highway and the suburb of Kettering were received by the chase team as the payload descended through the cloud layer at 1000 feet. The foxhunters closed in on their prey. Tom N9DZJ called in that he was very close to the payload but couldn't see it (it was 200 feet directly ABOVE his van). Larry WB9YAJ was about 200 feet behind Tom and actually saw the package parachuting down. If there hadn't been another car in the way in front of him, he

Photo C. A picture perfect takeoff. The balsa wood fin really helped prevent the payload from spinning

could've jumped out of his car and caught it before it hit!

Paul W9DUU and Chuck WB9IHS were in the car just behind Larry. They had an ATV downconverter and VCR in the car and videotaped the actual payload footage of the landing. It was great watching the final moments as the package narrowly missed a warehouse roof, bounced off of a tree limb and landed in a yard just 10 feet from the road. The package landed with the TV camera pointing up at the treetops. Shortly after landing, it showed the smiling faces of the chase team waving into the lens!

Although the 35mm film camera froze up after 60,000 feet, some great shots of the clouds were taken up to that point.

The DARA group had such a great time with this first flight that they plan another flight at 9 a.m. on the morning of October 6. For more information, check into the launch information net on 7.258 MHz (MIDCARS) just prior to liftoff. 73

Photo D. The Dayton Amateur Radio Association launch and recovery team.

Photo E. Landing site (10 miles southeast of the launch point). The recovery crew (l to r): Jeff KA8WLV, a neighborhood resident, Chuck WB9IHS, Paul W9DUU and Tom N9DZJ (Larry WB9YAJ not in picture).

Photo F. Photo from 60,000 feet (taken from the onboard 35mm film camera).

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HF RTTY

The theme of this issue of *73* is HF antennas. HF antennas suggest HF RTTY. That is quite a different animal than VHF RTTY in several ways, so we'll spend some time exploring the lacets peculiar to HF RTTY operation.

To begin with, just where do you find a RTTY station on HF? I spent some time tuning around the ham bands, to see just where the activity was on a typical summer's eve. Here in Baltimore, the traditional "hot spots" of 3620 kHz and 14.080 MHz remain one's best bet to find a RTTY QSO. The lead, at least during the early summer, goes to 20 meters, where one session's monitoring picked up stations from all over the United States, several in Europe, and Israel.

Less channelized than VHF, RTTY operation on the HF bands tends to be a bit more hit-or-miss, usually with CQs and RYs being heard. One great advantage to setting up for HF RTTY is the W1AW RTTY bulletin. Currently being sent daily at 0100Z, 0400Z, and 2200Z; and Monday through Friday at 1500Z: RTTY bulletins are sent on 3.625 MHz, 7.095 MHz, 14.095 MHz, 18.1025 MHz, 21.095 MHz, and 28.095 MHz. The transmissions are in 45.45 baud Baudot, 110 baud ASCII, and 100 baud AMTOR in FEC mode. For the amateur setting up an HF RTTY station, these automated bulletins, sent on time, on frequency, and with a strong signal, often provide just the tool to line up the receiver or converter. The information they provide, frequently the latest FCC ruling or information, is not a bad side benefit, either!

Transmitting RTTY on HF may take several paths, as well. A basic CW transmitter may be frequency-shift keyed with a diode and capacitor placed across the frequency-determining element. This "shift-pot" technique was in widespread use before the advent of frequency-synthesized transmitters. Suitable circuits have been printed in "RTTY Loop" before, and I will be happy to run some of them again, if there's enough interest.

Several transmitters provide an internal RTTY mode, and there's also an external adapter specifically designed for RTTY. If such a device is in your hands, going digital is simply a matter of flipping a switch!

The bulk of "modern" amateurs, however, are injecting a frequency-shifted audio signal into the audio input of their SSB transmitter to obtain FSK. This is fine, as long as the injected waveforms are pure, clean sine waves, and the transmitter has an adequately suppressed carrier and unwanted sideband. More and more, modern transmitters accomplish this task with aplomb.

The simple terminal unit demodulators, often used on AFSK circuits on VHF, are frequently unable to handle the rigors of HF communication. Signals below 30 MHz are plagued by static crashes, fades, and interference rarely heard on an AFSK signal. The TUs, therefore, need to be a cut above the simple one-chip wonder. While plenty of older designs, such as the venerable W2PAT terminal unit, are extant, the striking advances in technology over the last several years would suggest that, if at all possible, you investigate obtaining one of the integrated, multimode controllers. Units by AEA, Kantronics, and others provide incredible versatility, with an ease of operation only dreamed about years ago.

Having covered where to operate, the transmitter, and the demodulator, for all intents and purposes, any receiver good enough for SSB is good enough for RTTY. Now we are left with the display device. Here you have three choices: a mechanical teleprinter, a dedicated RTTY terminal, or a general purpose computer.

Let me say it here: Mechanical teleprinters are wondrous marvels that absolutely mesmerize me when chugging away with their covers removed. They are also noisy, messy, heavy, and require more attention than many children. If you have one and can keep it going, more power to you. My Model 15 and Model 14 tape equipment were relegated to the storeroom, along with the ASR-33, as soon as a quiet computer printer showed up. I don't have the heart to throw them away, and somehow I always feel I will get them running again.

Dedicated RTTY terminals had their heyday about 10 years ago. You don't hear much about them anymore, with general purpose computers gaining so much ground. If you have one, as with a mechanical teleprinter, use it! But, as with the former beasty, I could not see going out today and buying one.

That leaves us with computers as intelligent display devices. I've seen them all, and you can't beat 'em! I can sit, typing this article in my word processor program, and hit a few keys and switch into the terminal program for my demodulator. Using Windows on a PC, or on a Mac (I presume), you could even monitor the traffic in one window, while attending to some other task in another. Ah, the wonders of the modern age!

The one thing you won't get from me is a specific recommendation for which computer to buy. There are clear advantages to the inexpensive route, as discussed last month, and there are those who will only be happy with a multi-megaflop wonder. Unless you are devoting the computer to RTTY operation, and RTTY operation only, choose the computer with an eye toward what else it can do for you, not how well it can send data over an RS-232 line. That task is no great feat.

Oh, yes, before I forget—HF antennas. You need one! Go ahead and put up one that will work, one that looks good, one that the wife will tolerate. I could tell you a story about the 80 meter vertical I put up, and how I sold the wife on that one, but I'd have to change too many names to protect the guilty. You get the idea.

I've been enjoying the responses many of you have been offering to the question of what frequency RTTY signals are really on in the HF spectrum. Early returns indicate that there is no consensus as to how to specify a RTTY frequency. That and more are topics for future "RTTY Loop" columns. In the meantime, let me hear from you by mail, at the above address, on CompuServe (ppn 75036,2501), or on Delphi (username MARCWA3AJR). 73

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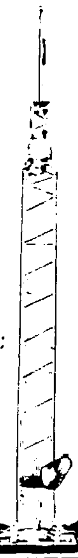

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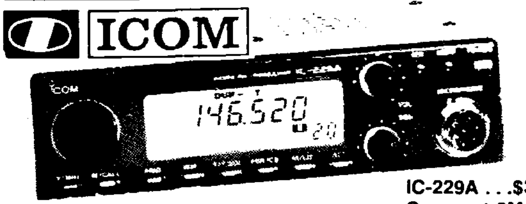

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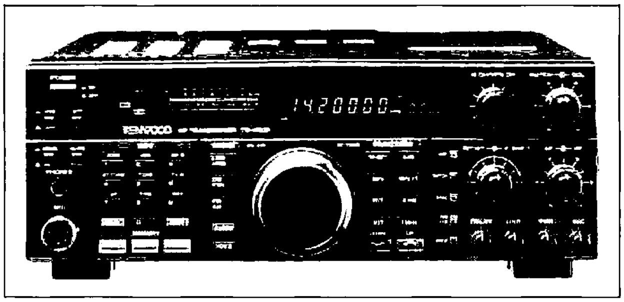
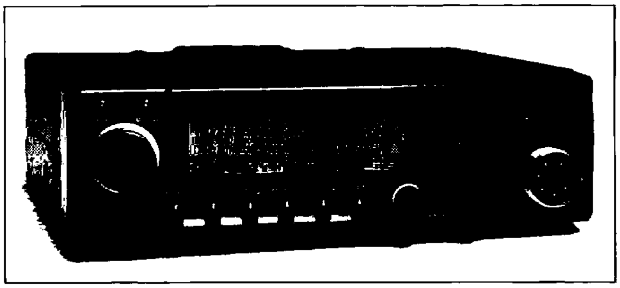


KENWOOD

Kenwood has introduced two new HF transceivers, the TS-450S HF (which replaces the TS-440S) and the TS-690S (replacing the TS-680S). The TS-450S/TS-690S offer many new features, including: direct digital synthesizer; fine tuning function; receiver dynamic range of 108 dB; RF power output control for all modes; the choice of either transceiver with or without the built-in automatic antenna tuner (80–10 meters); and many other features.

The suggested retail price for the TS-450S with the tuner is $1,550; without the tuner, $1,350; for the TS-690S, $1,550. *Kenwood U.S.A. Corporation, 2201 E. Dominguez Street, Long Beach CA 90810. Tel. (213) 639-4200; FAX (213) 604-4487.*



ICOM

ICOM has released the three-pound, 5.5″W x 1.6″H x 6.9″D IC-2410A/H 144 and 440 MHz dual-band transceiver. Its features include simultaneous receive on the same band, two versions of output power, crossband repeat, and 36 memory channels. It is microphone controllable.

Price unannounced at present; for more information, contact *ICOM America, Inc., Corporate Hadquarters, 2380 116th Ave., N.E., P.O. Box C-90029, Bellevue WA 98009-9029. Tel. (206) 454-7619; FAX (206) 454-1509.* Or circle Reader Service No. 201.

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Kits start at $9; toroids begin at $1 each, and ferrite beads at $2.75 a dozen. Ask for a free information packet containing product listings, price sheet, notes on applications, and order form. *Spi-Ro Manufacturing, Inc., P.O. Box 5500, Dept. 105, Lakeland FL 33807-5500. Tel. (813) 646-7925.* Or circle Reader Service No. 209.

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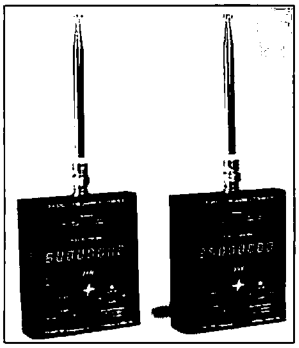

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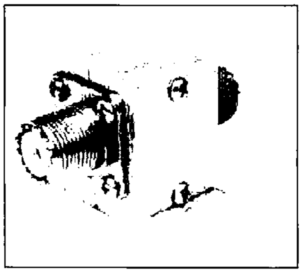
SOLARCON

Solarcon Corp. of Holland, Ohio, manufacturer of the complete line of Antron antennas, as well as other antennas for amateur radio, CB, and the cellular and scanner markets, announces that June 1, 1991, it retired the Antron name, which was created solely to market the A-99 base station antenna. From now on, Antron antennas and all of their other products will be marketed under their original company name, Solarcon.

The company is still located at the same address. For more information, contact *Solarcon, P.O. Box 176, Holland OH 43528. Tel. (419) 865-5877; FAX (419) 865-9449.* Or circle Reader Service number 202.



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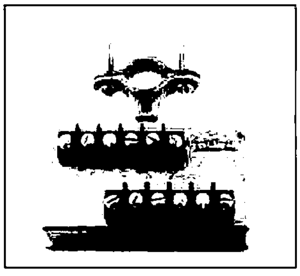

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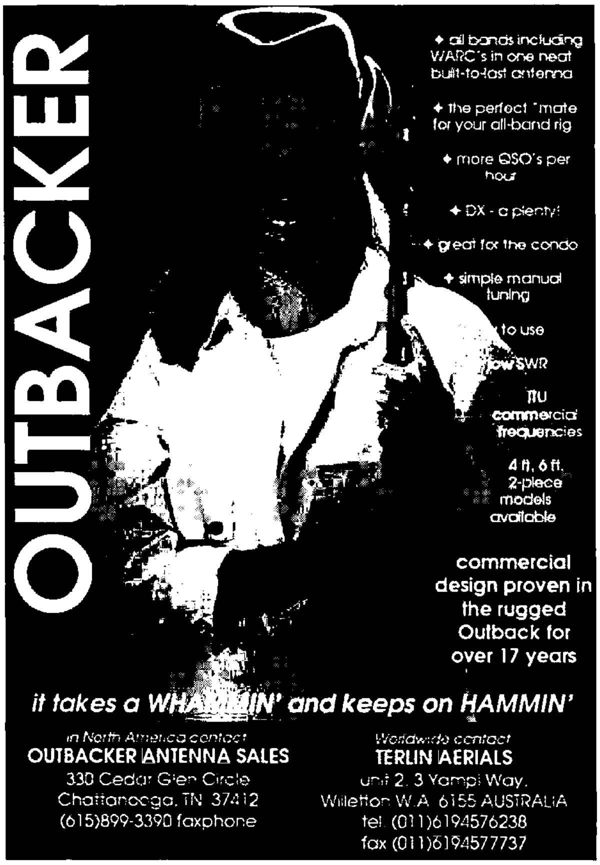

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Needed: Service manual or copy for Kenwood TV-506 transverter, VFO-820, ICOM 251A. Also need manual for Johnson Mesenger 1 or 2. Will gladly pay copy and postage costs. *KS4S, Nyles McKeithan, 1308 North Pine Street, Lumberton NC 28358. (919) 738-1644.*

Need manual and schematic for Clegg FM-27 2m transceiver. Will pay copying costs. *Jon Danford AA0EQ, 2115 Joplin Av., Joplin MO 64804. (417) 781-5243.*

Wanted: 10m handheld "Handy" with crystals and instruction manual. Portable antenna. Small solar pack or light-weight, hand-cranking compact generator to charge deep-cycle battery pack. Needed for unusual DXing adventure. *H.L. KC6RKO. 249 E. Redondo Beach Blvd., Gardena CA 90248. Day: (213) 327-7777.*

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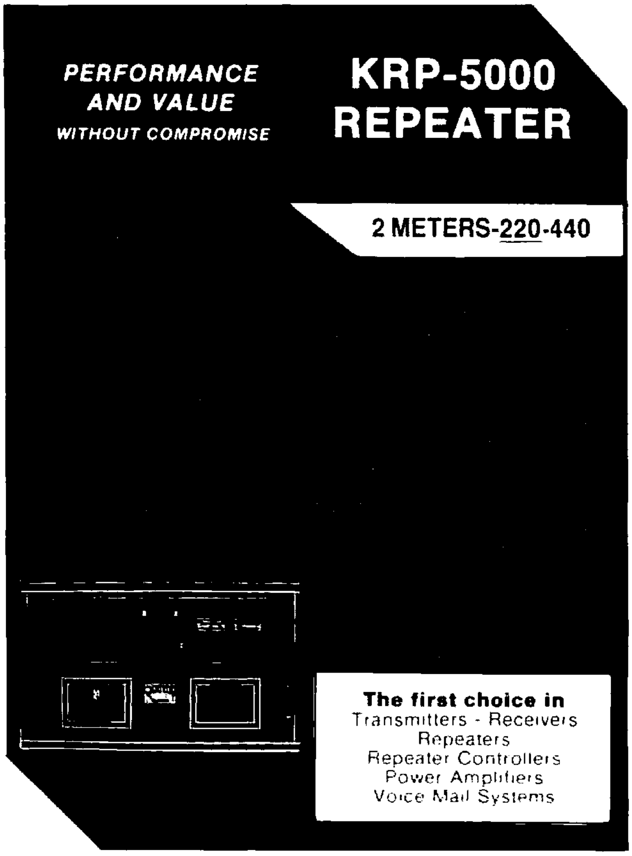
Need operating manual and/or service manual for NCR model 1014 computer so I can upgrade and operate packet and RTTY. NCR sold these to schools. Copy OK. Call (401) 723-5308 first if you expect money for it. *Joel S. Look W1KCR, 35 Goff Ave., Apt. 507, Pawtucket RI 02860.*

Wanted: IBM XT manual; ICOM HM 10 mike; Atlas DD-6C digital readout for Atlas 210X; Heath digital readout for HW-101; power supply for Commodore C-64. *A. Campo, 816 West Knapp Street, Rice Lake WI 54868.*

Wanted: CW filter (400Hz) and microphone for Heathkit HW-101 transceiver. Ideas for substitutes from original equipment welcome. Also interested in any modifications. Will pay costs and postage. *Edward J. Mathes, 1732 Beechwood Drive, Farmington NY 14425.*



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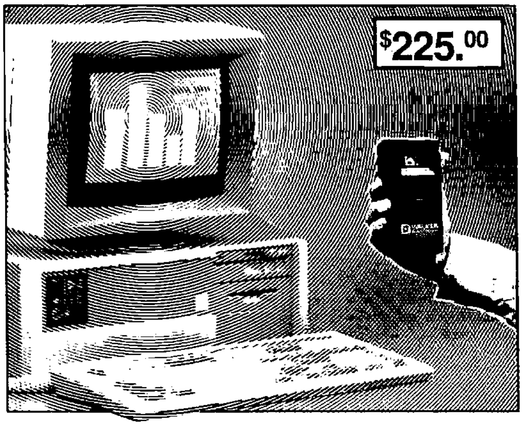

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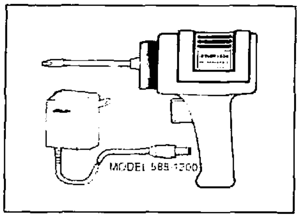

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GAI SYSTEMS

GAI Systems has a new product directory and buying guide for amateur radio operators. Called *HamStuff*, the directory contains information about more than 1,000 vendors of ham radio products and services, and descriptions of more than 5,000 products. Part I, "Stuff to Do," includes chapters on youth activities, programs for disabled hams, organizations, and publications. Part II, "Stuff to Buy," has product descriptions. Part III, "The HamStuff Index," lists addresses and information on vendors. *HamStuff* is published by Walt Garrett NØMAL. He plans to issue annual revisions to the directory.

HamStuff is available for $19.95 plus $3 shipping and handling. Contact *Walt Garrett at (314) 831-6464/6918. GAI Systems Group, P.O. Box 5832, St. Louis MO 63134.* Or circle Reader Service No. 208.

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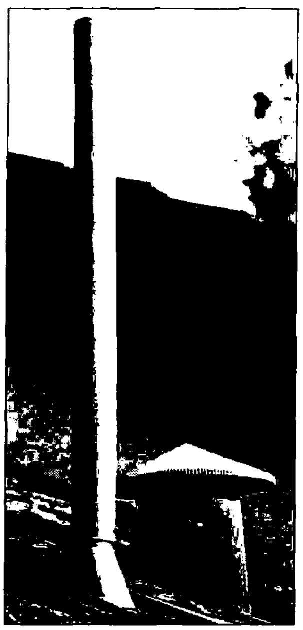
Price, $60. Specify disk size. Requires IBM/compatible computer with MS-DOS, EGA monitor, and at least 512K RAM. Larger arrays are available as option. *A/V Technology International, Inc., P.O. Box 97, 432 Cherry Street, West Newton MA 02165. Tel. (617) 965-3866; FAX (617) 965-1865.* Or circle Reader Service No. 219.

MFJ

MFJ has just released the MFJ-1268 PC Memory Keyer, a combination of IBM/compatible software and hardware that turns your computer into a powerful memory keyer. It hooks up easily between your computer and radio. You get 100 function key macros that you can easily set to send any messages or characters. You can set a macro to send another macro. Other features include incremental serial numbering, speeds from 5–40 wpm, variable speaker tone (or speaker off), weight adjustment, and instant access to online help.

Price is $50, with MFJ's one-year guarantee. *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762. Tel. (601) 323-5869; FAX (601) 323-6551; (800) 647-1800.* Or circle Reader Service No. 211.



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Electrosoft has released a new version of the CW-keyboard program and interface kit (described in the January 1991 "New Products") for IBM/compatible MS-DOS computers. The new version adds the capability to receive CW; the original program only transmitted CW. The program/interface receives CW from the receiver speaker and keys the transmitter via one of the computer's serial ports. It copies CW from 2–100 wpm, automatically tracking changes in speed. Received messages are displayed in reverse video in the upper window of the split screen display. Transmitted messages are copied from the bottom window to the top window using regular video display. Received and transmitted messages appear in the order they occur. An "R" in the top status line blinks brightly when the CW tone is present, helping the operator to tune the frequency and volume of the receiver for the best reception.

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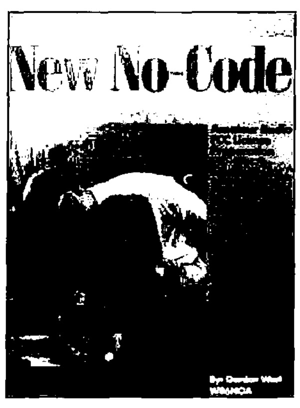

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Price, $9.95. Look for it at your local Radio Shack or ham dealer! If you can't find it, call *Master Publishing, Inc., 14 Canyon Creek Village MS 31, Richardson TX 75080. Tel. (214) 907-8938; FAX (214) 669-4028.* Or circle Reader Service No. 220.

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LOOKING WEST

Bill Pasternak WA6ITF
28197 Robin Avenue
Saugus CA 91350

The Great 220 Bandplan Debate

Will anyone win? I think it's rather obvious that the Federal Communications Commission was wrong when it confidently said that the amateur community would find a way to absorb activity previously in the 220–222 MHz spectrum into the 222–225 MHz band. Either that, or it had only localities like Norman, Oklahoma, and Hilo, Hawaii, in its bureaucratic mindset when, in the test of the report and order deleting 220–222 MHz from amateur use, it assured the ham radio community that a transition to a new and smaller 3-MHz-wide band would be without incident. The Commission may know how to write regulations, but it is now painfully obvious that it has no concept of humanity in general and human nature in particular. As a result of this lack of understanding of Homo sapiens' nature, the so-called "easy transition" has become an open war pitting special interest against special interest, and ham against ham.

As I write this column in early June, there are still 50 states comprising this nation, almost that number of concerned frequency coordinators, and at least three times that number of band plans for the reorganization of activity in the 1.25 meter band. Most of the proposals fall into one of two categories. They are either "altruistic" in offering (demanding?) an equal split of the pie for all mode users, or they are selfish in favoring one mode over all other interests. What I see emerging as the 0000 UTC on August 28th "Vacate Day" draws closer is a growing awareness among the minority spectrum users, i.e., the EME enthusiasts, the low-power CW and SSB DXers, the beacon owners, and hams of that ilk, that the majority of their peers will no longer tolerate their existence! That majority calls itself the "FMers."

Why FM Feels It Will Win

Let me begin by saying that I have no ax to grind for or against either side. The time I spend on 1.25 meters is as a user of the N6ENV repeater's autopatch and 223.5 MHz simplex. Sometimes I wander to N6NFQ's fine system, or that of the long-established Valley Good Guys Amateur Radio Club, but that's about it. I actually prefer one-on-one QSOs, all but impossible on repeaters. In years past, I have spent many happy hours in 6 and 2 meter AM and SSB rag-chews and I have chased VHF DX on SSB. Long before most hams realized it was possible to talk from Brooklyn, New York, to Atlantic City, New Jersey, directly on 6 meters, I had racked up a fairly impressive total of 42 states worked and 37 confirmed while running only 7 watts AM, crystal-controlled on 50.4 MHz. In 1969, I also codesigned, built and installed WA2ZWP—the nation's first 15 kHz split-split repeater. (And I thought I had proven that 15 kHz would not work, but nobody listened—hi.) For the past 28 years I have been writing about VHF/UHF, FM and repeater matters for *73 Magazine*, and I have served as a frequency coordinator on two coasts. I will not say that I have "done it all"; far from it, but what I have come to possess as a result of being on both sides of the fence is a far better understanding of certain amateur radio political issues than most.

So let's get right down to the nitty-gritty of what has happened here and in most other urban areas. Simply, places like Southern California have now decreed that 222–225 MHz shall be forevermore an FM band, with a smattering of packet begrudgingly welcome. Other areas, mainly those under the umbrella of the Mid America Coordination Council (MACC), have taken the view that FM will have to vacate a part of the band to make way for the re-allocation of weak signal modes. This will work in MACC territories such as Nebraska, Iowa, Kansas, Missouri and the like, but what is going to happen when the MACC-affiliated Illinois Repeater Association attempts this in Chicago where they have every channel pair filled from 222–225 MHz? I frankly doubt that any repeater will go off the air if a repeater coordinator says to vacate spectrum to make way for the displaced users of 220–222 MHz. And, if a coordinator decides to flex its muscles and try to force systems to vacate, the coordinator will either be ignored, or more likely, be sued.

But the League Will Solve It?

Let's put ourselves into the position of a 220 repeater owner who is told by a frequency coordinator that he has to take his system off the air to make way for another mode. What do you think his reaction will be?

Keep in mind that he already has the frequency. He has the gear. He has the repeater site and most important, he has the backing of his users—the same users who vote for the ARRL director and vice director every two years. So he picks up the phone, dials up his director and says something like: "This is Joe Jones and I own the 222.90 repeater that's been told to get off the air. Mr. Director, you seem to forget that the political power in ham radio lies in only two places: the DXers and contesters with their money, and us repeater folks with our votes. It's not with that handful of crazies who bounce signals off the sun and the moon. Now, do you or don't you want to be re-elected next year?"

If you think this won't happen, and that the ARRL hierarchy won't bend to this pressure, you are very naive. The ARRL Board of Directors is the epitome of the "Old Boy Network." Elected League officials know where their bread is buttered and where the votes to keep them in office come from. Because of this, they instinctively bow to popular political pressure. Look at the turnaround they did on no-code when they realized that code-free licensing would be more popular then unpopular.

What about a quick response by the ARRL for a new approved "Official ARRL 222–225 MHz Band Plan"? If the directors do anything at all—which I tend to doubt—they will pigeonhole the subject by sending it back to the VRAC and VUAC to discuss for the next decade. That way, they make no decision and placate everybody. How many years did it take the ARRL Board of Directors to decide that all three band plans for 2 meters were proper? I think it was 18 years, to be exact. I do not expect the ARRL Board of Directors to do much else but procrastinate, and point to their "local option band plan" escape clause as a way of collectively distancing themselves from this ham community need.

> ***"As we get more no-code Technicians, there will be a call for more and more repeaters for them to operate on."***

Let's Go to the FCC!

I have heard that a few of the EME folks in Texas are thinking of filing a petition with the FCC to request partitioning of the 1.25 meter band to take 222–223 MHz as a narrowband-only emissions subband, and 223–223.5 MHz as a not-to-be-used buffer zone to protect the noise floor of the lower 1 MHz. I suspect that the FCC will get a lot of petitions like this over the next year or so. I also doubt that any will ever see the light of day, for two reasons.

First off, the FCC will ask the ARRL what to do. The ARRL will come back and say, "We don't know." The FCC will then say, "If the ARRL has no idea what to do, and they are the representatives of the wishes of the 'majority' of radio amateurs, how can we, the FCC, know what's best? Maybe we should let it alone and see what happens over the next several years." And, mark my words, they will.

The Law of Supply and Demand

There is something else that the average ham, in his altruistic zeal, tends to overlook: the law of supply and demand and its effect on the hobby. From 1950 to 1968 (approximately), the national (not California) demand was for VHF and UHF gear that was experimentally oriented. In the old days, all of us were "technicians building our own gear," and we were all DXers in the sense that we were all striving to get a better signal to the guy we were talking to. That began to change in the mid-1960s when Ed Clegg W3LOY (Clegg Labs) began putting high quality, made-for-ham-radio transmitters, receivers and transceivers into the hands of amateurs at prices well under what they could home-brew a piece of gear for. Then came Swan with its 250 and 250C: a pair of radios that radically changed the operating habits of those of us on VHF and UHF.

By 1969 or 1970, the rest of the ham world had discovered what California hams had known since the 1950s, FM and repeaters. With the advent of the six-channel Regency HR-2, the six-channel Inoue IC-2F and the three-channel Galaxy unit that never worked, the face of VHF and UHF operating was again changed forever. For all intents and purposes, 2 meters, then 450 followed by 220 and the rest of VHF and low UHF, became "operator" bands with the "experimenter" not just taking a back seat, but literally being phased out.

What does this have to do with the law of supply and demand? Just this: How much SSB and CW gear is made vs. the number of FM transceivers and handhelds? The manufacturers are well aware that the big money lies in two, and only two, markets. These are HF SSB and VHF/UHF FM. True, there have been spurts of weak signal equipment coming to the market, but these units are for the most part nothing but derivatives of existing HF transceiver designs. They come and go quite fleetingly. In fact, the only reason that we are seeing so much new 6 meter gear is because 6 meters has been opened up in most of Europe.

For three decades, the United States accounted for 99% of the potential 6 meter market, and for the past two and one-half decades there has been only a smattering of advanced gear for that band. Most serious 6 meter DXers still prefer the old tube-type Drake TR-6 to anything else. I saw one sell for over $1,500 in the Dayton flea market in 1990. That was three times what the radio sold for in 1968!

The new FM gear for the 222–225 MHz band has either been designed, is in the process of manufacture, or is already on the boat on its way over. Unlike a decade ago, the people who manufacture and import ham gear are not the quiet fellows they were. The amateur radio industry knows that it supplies a special interest product, and to survive, it must sell mass quantities of "product" into mainline use. On HF that means a transceiver for each price range, with 99.9% of the activity being CW and/or SSB.

The market on VHF and UHF is FM. The big three know it. The smaller sup-

pliers also know it, and I think that companies like Radio Shack, Sears, Ward's, Penney's, K-Mart and countless others—others who I believe will come to mass-market ham gear—will also show that they understand this basic marketing strategy. (You should not be all that surprised that I am predicting that a lot of the nation's mass-market marketers will eventually join the ranks of those selling amateur radio equipment. To me, this deduction is as simple as the two words "no-code.")

I think the ham industry—at all levels—is now geared to no-code. Radios are becoming simpler to operate, with much of what's needed to get on the air being preprogrammed into ROM. Plug in an antenna, turn on a radio, key up a repeater, and talk. Not really that different from a TV set, a stereo, or—heaven forbid—a CB radio.

In years past, the manufacturers and importers of the gear we "must" all use refrained from speaking out on volatile subjects for fear of losing business to one another, or to the realm of the home-brewer. But that, too, has all changed. Parts are very hard to come by, and they are getting harder to find every day. This makes the home-brewing of any gear, let alone something like a Kenwood TS-950 or an ICOM IC-781 or a Yaesu FT-1000 (did I leave anyone out?), all but impossible for the average amateur. Therefore, for most of us, this means we buy what's on the market or we do not get on the air.

And Then There Is Politics

Then there is the political impact of no-code for the remainder of this decade. If you are watching the FCC's Tech class licensing figures—and I do—then you see a rather interesting exponential growth pattern developing. Admittedly, it's very early to accurately predict the outcome a decade from now, but if you just project current growth patterns for Techs from the past three months, you find a steady 270% increase each month. If this pattern were to continue for only, say, two years, the code-free licensees would be the dominant license class in the nation. And, with numerical dominance comes political desire.

When the no-code operator becomes the dominant political voice determining the destiny of United States amateur radio policy—and the I believe no-code ham will become that kind of political force—what will the VHF and UHF bands be like? I think that the answer is "utility communications" with little or no room left for exotic experimentation and non-mainline operation.

What Does it All Mean?

I have spent the preceding paragraphs trying to paint what I feel is a realistic national and international picture for you. You don't like it? I have to tell you—neither do I. But hams, myself included, are known to be far more altruistic than realistic. To those of you who would find it far easier to kill the messenger than to accept the reality of the message, I can only offer a bit of pity. You either live in a rather insulated world or have listened to one squelch-crash too many.

When I say that this is only the first of many times—most yet to come—when spectrum will be lost to non-amateur use and we will again have to contract our operations, do not think that my words are insanity. Rather, sit down, read the background information available on the upcoming WARC sessions, and decide for yourself. The cards are stacked heavily against the minority of weak signal enthusiasts, and well in favor of "Joe Ham" who has gone out and spent $400 for a transceiver with "...all those repeaters built in."

I do not see any real future for the weak signal experimenter and exotic mode operator on 222 MHz, or on any other VHF or UHF band, except those in the GHz range—if we still have any of these left after WARC '92 and WARC '93.

I know that forcing the creation of a subband that will be looked on by the masses as the domain of the elite will only bring provocation. Trying to forcibly take more then the masses are willing to give will only bring on an intermode war that the masses, by sheer number, will have to win. Trying to forcibly create a subband by FCC regulation will bring a negative response from the majority of the amateur community, and possibly from the American Radio Relay League. Yet, is it right for the masses to tell the few to go away forever? Is it right for "them" to tell "you" that "you" cannot enjoy your interest because "they" will not give you the room to do so?

Maybe We Need Two Bandplans?

Some have suggested that we have a pair of new 222–225 MHz bandplans. You might say, "one for the crowded city" and another for "the great outdoors." I fear that this approach is not a real solution. Rather, it is a Band-Aid™ that will work only as long as the "great outdoors" remains sparsely populated. No-code will change all that.

As we get more no-code Technicians, there will be a call for more and more repeaters for them to operate on. A lot of these machines will be outside of the traditional urban regions where 2 meters and 440 MHz are already congested. As a result, many will be forced to make their home in the 222–225 MHz band. These new repeaters and their users will erode the "great outdoors" bandplan and urbanize it. The DXer and weak signal experimenter will again be forced off, and feelings will once again be hurt.

To understand what I am saying you have to let go of today. You have to visualize the future and think in numbers of tens of thousands of new hams coming to the VHF and UHF bands in the next several years. The vast majority of them will be demanding telephone-like quality to their communications—be it voice or data. Having multiple bandplans based on current activity is closing one's eyes to the future. Have we not done that enough already? 73

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RF Filters for VHF and Above

With all the laser applications now seeded in the last few columns, I want to sit back and see what develops. I plan to continue my pursuit in this part of the spectrum, and I'll be glad to pass on information and applications you want to share. This month, in response to questions, I will cover RF filters and expand on a few applications. The beauty of some of these filters is that they're almost ready to go, right off the shelf. I'll start by describing some of the filters that I've used in past years which still have desirable traits today.

The subject of filters generally comes up when you have a piece of equipment that works, but needs improvement. This was the case with a simple 2 meter FM rig I used back in 1960. The receiver had a 6BQ7 for the front end, and the transmitter was home-brewed with 6AQ5 tubes in the multiplier string. Normally this tube was used for a receiver audio stage, but it worked well at 2 meters mainly because it was available.

The problem I was having was a desensitized receiver, which I traced to several local strong high power commercial transmitters. They were tearing up my receiver; though they were located over 10 MHz away, I could hear them in several spots on the 2 meter band.

You might wonder what this old rig has to do with the modern radio. Well, some of its problems still plague us, especially RF de-sensitization.

Considering their small size, circuits in today's radios work fantastically well, their quality and sensitivity far exceeding that of early radio. But wide-band coverage radios still suffer from adjacent channel interference, or poor selectivity. Selectivity is the radio's ability to operate to full specifications while functioning near an off-frequency transmitter.

Being Selective

What happens in typical de-sensitization is that your receiver goes numb. If you're mountain topping or on Field Day, the view of the city may be great, and the location ought to be great, too, but you get poor performance. You might not even know that your transmitter is getting out, since your receiver is operating poorly. Besides poor performance, the only other clue might be some trash in the unsquelched condition. The problem is quite simple: front end overload or a de-sensitized receiver.

What you usually find at these locations are commercial radio repeaters, or local TV or FM stations, who also thought the location was great. Trying to operate an unmodified radio, like a plastic HT with miniature filter circuits, near their high power transmitters will only cause you grief. About the only radios that don't suffer from this problem are some of the single or multi-channel mobile "taxi" or "police" radios. They have quite a few selective tuned circuits on the receiver input that reject nearby off-frequency signals. Note: these radios have the bandwidth of their front ends reduced from several megahertz (our HTs) to a fraction of that bandwidth.

Just as the commercial radios solved this problem, so can we. The solution is a filter installed on the antenna of our radio to limit or reduce the strength of adjacent RF signals. We design the filter to pass only that portion of the 2 meter band we desire, and to reject other frequency components. Most interfering transmitters operate at 152 MHz and above, making a high *Q* filter very effective in limiting what the receiver input circuit can see.

On field trips I usually use an ICOM IC-02, which is one fine radio unless you're operating near high power TV or FM transmitters. However, connecting a bandpass filter tuned to the frequency of operation restores my IC-02 to full performance.

First, Find the Right Can

The filter I constructed years ago for much the same problem consisted of a beer can cavity filter. It was a steel or tin can, not aluminum. Find one of the larger soup cans that will take solder. To get the proper length of can for your particular application, you can try other cans; tennis ball and fruit juice cans are suitable for frequencies of 2 to 3/4 meters. Other types of cans can be used, depending on length and solder-ability.

The coaxial connectors are mounted on opposite sides of the can, about an inch and a quarter from the grounded end of the filter. The coupling link runs from the connector near the center element, then angles down and is soldered to ground. The spacing on the link is adjusted for insertion loss and impedance matching. The bottom of the filter is covered by a copper or tin plate, or anything that will take solder. The can forms a cavity that is adjusted by a small value variable capacitor mounted at the top of the element.

The capacitor resonates the cavity to frequency. Connect the cavity in line. While listening to an active repeater, vary the capacitor for the highest S-meter reading you can get. This is a hokey method of setting the cavity to frequency, but if you do not have any test equipment it will work quite well.

Do not try to transmit through the filter if it will not pass the receive sensitivity test. When it does pass this test, use only low power until you have thoroughly evaluated the filter. There should be almost no difference in S-meter readings with the filter in or out of the circuit. See Figure 1 for construction details.

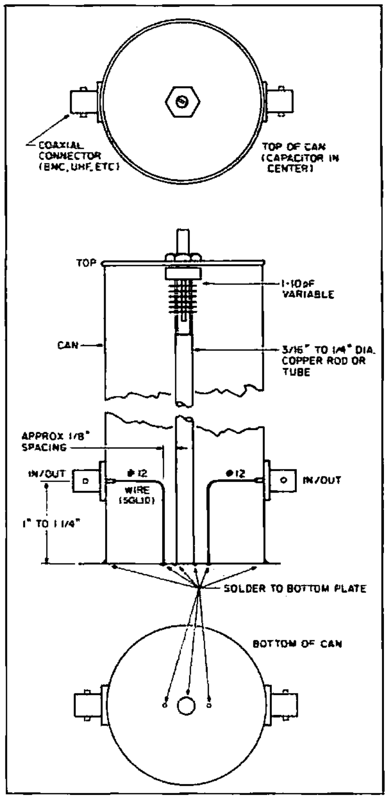

Figure 1. Schematic for the 2 meter, 16-ounce beer can cavity filter.

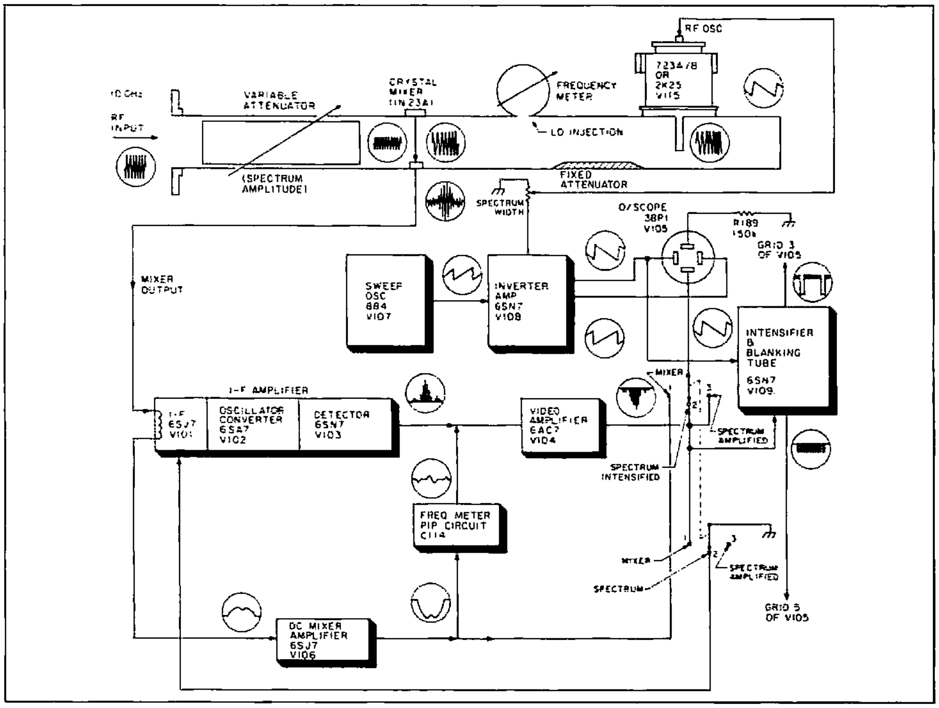

Figure 2. TS-148 surplus spectrum analyzer block diagram. The 10 GHz frequency meter in the photo was removed from this test set.

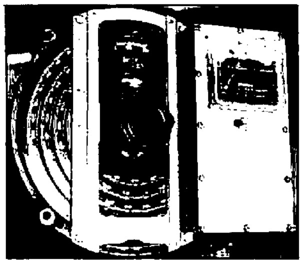

Photo. 10 GHz frequency meter. TS-148 dial removed from test set. The waveguide opening is in the rear.

Heat, Power, and Size

My filter had a very sharp peak at the frequency it was adjusted to, allowing operation on a very narrow band of frequencies. You can use the filter for transmitting, but the power must be low (5 to 10 watts maximum) due to component heating. You can check the filter's performance on transmit with your SWR bridge. It should give a nominal low reading. To obtain minimum SWR, some positioning of the input/output links may be necessary. With the filter in place, adjacent transmitters should not give you further problems.

If you change your frequency of operation, don't forget to change the filter tuning, as it is quite narrow. I usually set mine and use it only on certain hilltops, removing it when I am mobile. This avoids distracting problems that could come up while I'm driving. Normally, a filter is not needed in mobile applications, as the location changes rapidly, especially on the California freeways.

A variation of this simple cavity type filter is the trough line circuit, housed in a rectangular enclosure with one side open. There is nothing wrong with using either type of filter for transmitting, but you must keep the power low. Insertion loss runs about 1/2 dB. Commercial, high power transmitters use the same type of filter concept, but the design incorporates a very large cavity structure nearly 1/4 wavelength long. With a tin can, losses are greater. A small filter can't handle very high currents.

As noted, short filters using variable capacitors should be limited to transmitters of 10 watts or less. A 1/4 wavelength filter for 2 meters is almost 20 inches long, and not very portable. It must be made of heavy and durable material, considering the high RF currents it is subjected to. You probably have a similar filter in your local repeater duplexer to connect the receiver and transmitter to the same antenna and to reject off-frequency signals.

Mailbox Comments

Robert DePaul of Union City, New Jersey, is converting a TS-148 radar test set for use at 10 GHz. This test set is available from many surplus dealers. While it is tube type and somewhat bulky, I used two of them in my first 10 GHz test sets to set up, with my microwave group, 10 GHz transmitters.

The TS-148 operates from 8.5 to 9.8 GHz. This unit is a spectrum analyzer of the old world, about 1950 or '60 vintage. It has an o-scope presentation with variable frequency meter (mechanical) built inside the case. It's about 14 inches square (front panel) and 16 inches deep. Power is from 110 AC mains.

Robert's conversion involves removing the klystron tube and breaking off the klystron's brazed limit screw. But you can also file off the tube's brazed lock nut, which allows you to adjust the screw, compressing the cavity past the factory set limit. This raises the frequency for operation on the 10 GHz band.

To convert the wavemeter for 10 GHz, remove the front cover plate to access the dial. Set the dial to the highest frequency (a 966 dial reading = 9.66 GHz). With the unit face up, partly unscrew the four corner screws holding the dial plate "MC/10." Loosen the top screws more than the bottom screws. Now, carefully raise the top of the dial holder and fudical with the MC/10 dial set to 966; drop two tracks with the MC/10 dial, now set to read 899.5 (8.995 GHz).

This makes the cavity electrically smaller, and resonant on the 10 GHz ham band. Each frequency meter converted in this manner will be different, but close to the reading I obtained on re-calibration on 10 GHz, as follows: 10.280 GHz = 935.6; 10.250 GHz = 933.9; and 10.220 GHz = 932.2. This should guide you on what to expect if you do your calibration in the same manner.

If desired, you can return the meter to its original calibration by raising two tracks. If you want this reversibility, be careful when making the modifications. Before you set the unit on its bottom, tighten the screws to prevent the dial from shifting. See Figure 2 for a block diagram of the TS-148. Next month we will cover the TS-147 companion.

As always, I will be glad to answer questions about microwave or related topics. Please provide an SASE if you wish a personal reply. Best 73's Chuck WB6IGP.

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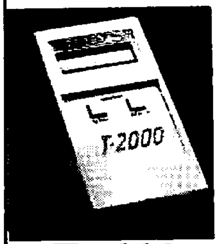

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John R. Somers KC3YB
Crisfield MD

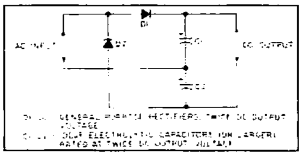

Fig. 1.

Listening to Your Rig While Doing Something Useful

Many times I've wanted to monitor a frequency for a scheduled call, or for a net to start, or to listen for some DX activity, but had chores I should have been doing that would keep me out of hearing range.

One solution was to turn the audio way up. The XYL soon put a stop to that. Another solution might have been a long earphone cord, but that probably wouldn't have been compatible with the hedge clipper.

A simple solution to the problem was provided by coupling an inexpensive FM transmitter module to the receiver audio, and listening on a portable FM receiver.

Circuits for short-range FM transmitters have been published, and several are available commercially. Almost any of these would work, but the easiest approach was to use the FM-1, sold by Ramsey Electronics in kit form. It is quite small, inexpensive, and can easily be packaged with a battery and microphone cartridge and placed next to the speaker or taped to an earphone. However, better sounding audio will result if the earphone jack output is fed through a reversed audio output transformer directly to the module, bypassing the microphone. In this case, a 500–1,000 ohm potentiometer across the unit's input may be needed to supplement the receiver's volume control.

Figure 3 shows a circuit that will accomplish this. Just tune to a quiet spot on the FM broadcast band and adjust the input levels for best fidelity.

I've actually used this gadget with an FM-earphone radio while mowing the lawn. And, I've had the added advantage of being able to QSY to some soothing music when the QRM got too rough.

Marty Kleinfeld K1FHR
Naples FL

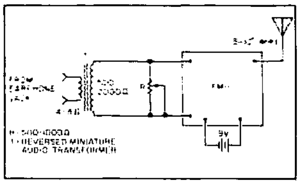

Fig. 3.

Adding a Gain Step Switch to the LM386 AF Amplifier

The LM386 is a very useful audio amplifier in an 8-pin DIP package. Variations of the LM386, identified by suffix numbers −1 to −4, provide up to 0.7 watts of audio to a low impedance speaker or headphones. This chip contains an internal circuit accessible at pins 1 and 8, so the overall gain can be set at 50 to 200 times by an external resistor and/or capacitor.

In some instances it can be desirable to limit overall gain to less than maximum, which corresponds to maximum current drain, especially in battery-operated equipment. A 10k ohm audio taper potentiometer is used normally to control the input level. A single-pole, three-position switch has been added so that the maximum gain can be set as desired between 50 and 200 times.

Figure 2 illustrates a typical AF amplifier using the LM386. Provisions for a speaker and phone jack are included. The speaker is silenced when headphones are plugged in.

J. Frank Brumbaugh KB4ZGC
Buffalo NY

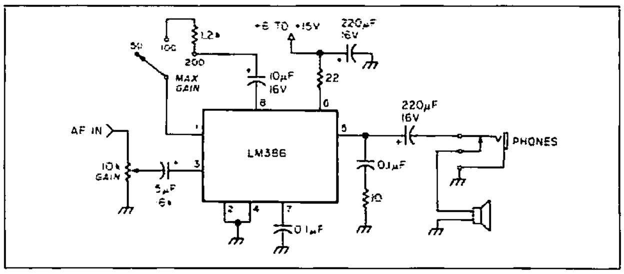

Fig. 2.

DX

Hams Around the World

Bob Winn W5KNE
c/o QRZ DX
P.O. Box 832205
Richardson TX 75083

The Penguin Islands

There's a new DXCC country. The number of DXCC countries has risen to 323 with the addition of the Penguin Islands to the list, almost a year after the application was submitted to the ARRL. The following ARRL Amateur Radio News Release dated May 31, 1991 summarizes it nicely:

"By unanimous vote (7–0), the ARRL Awards Committee has ACCEPTED the recommendation of the ARRL DX Advisory Committee that the Penguin Islands (ZS1) be added to the ARRL DXCC Countries List. That recommendation was based on Point 3(a) of the Countries List Criteria (separation by another DXCC country).

"The Penguin Islands, administered by South Africa, are situated off the west coast of Africa. Namibia (V5) separates the islands from South Africa (ZS1-6).

"To the best of our knowledge, there have been two creditable operations from these islands: ZS9A/1, DK9KX/ZS1 and DL8CM/ZS1 in July 1990, and ZS9Z/1 in December 1990.

"QSL cards may be submitted for DXCC credit beginning September 1, 1991. Cards submitted before that date will be returned without credit."

The ARRL news release mentions the callsign DK9KX/ZS1, but DK9KX (and other operators) actually signed ZS9AAA/1, not DK9KX/ZS1, during the first operation from the Penguin Islands. The callsign DK9KX/ZS1 is mentioned on the DXpedition QSL card, along with DL8CM/ZS1 and ZS9A/1, but I have found no one who has received a confirmation for a contact with DK9KX/ZS1.

QSL routes for these operations are: ZS9A/1 via OH2BH; ZS9AAA/1 via DK9KX (direct only); ZS9A/1 via ZS9A; and DL8CM/ZS1 via DL8CM.

Jarvis Island

Since before the AH3C/KH5J DXpedition (April 13–22, 1990), the question of separate country status for Jarvis Island has gone unanswered. This possibility is being tested by an application for separate country status submitted this past May by several of the AH3C/KH5J operators.

Eric K3NA wrote a lengthy and well-documented application for separate country status during early 1990, but evidently his document, if it was submitted to the ARRL, has not been acted on. During this past May another attempt at making Jarvis Island a separate country was launched by the AH3C/KH5J operators. Their application, which appears to use most, if not all, of the data compiled by K3NA, is based on Point 3(b) (a part of the Criteria that the DX Advisory Committee is attempting to change) of the DXCC Countries List Criteria: "Where two islands, of the government under Point 1, are totally separated by an intervening DXCC country (also under Point 1), 'each' island counts as a separate DXCC country. . . ."

This application shows that Jarvis Island is separated from Palmyra Island (the nearest U.S. land) by sovereign Kiribati territory. It is well-written and should give the DX Advisory Committee plenty to think about.

Myanmar (Burma)

The Myanmar DXpedition, led by Romeo 3W3RR (1S1RR, YAØRR, etc.), is now scheduled to begin in late August or early September. The callsign has not been made public, to prevent its use by pirates. The callsign will be announced about five days before the DXpedition begins. Romeo has a license that has been accepted by the ARRL. Romeo and company will operate from one of two possible sites: an island off the coast of southern Myanmar, or somewhere within the "Golden Triangle."

3CØ Annobon (Pagalu)

Annobon, or Pagalu, whichever name you wish to use, will be activated in August by the Radioclub Garrotxa and the STC URE Garrotxa. Transportation and licensing have been arranged, but the exact dates in August have not been announced. Contributions for this DXpedition may be sent to Radioclub Garrotxa, P.O. Box 56, Olot, 17800 Gerona, Spain. Thanks "DX News Sheet."

VP8 South Sandwich Island

The South Sandwich Islands DXpedition is a go again! This DXpedition is associated with the group that aborted their DXpedition last December. Eight operators, not yet identified, are scheduled to land on South Thule Island December 6 and be picked up on December 20. The research vessel *Abel J.* will provide transportation. According to the announcement received from KA6V and AA6BB, in order to discourage pirates, the callsign will not be released until the operation actually begins.

KA6V and AA6BB noted in their announcement, "Altho' we have some finances in the account, we do need to call upon your generosity. This new ship will cost only $50,000, which is considerably better than the cost of last year's vessel. . .$100,000. The cost of the vessel is the reason last year's DXpedition was cancelled." Please send contributions to AA6BB.

USSR—Oblast Ø52

Alex UA4HVV, who was active earlier this year as UA3Y/UA4HVV, will operate from oblast Ø52 during the last two weeks of August. He will sign UI7T/UA4HVV from a location called Dinosaur Plateau at 10,000 feet elevation. This location, according to Ed NT2X, has dinosaur footprints recorded in lava. Is this the first recorded hotfoot? QSL via UA4HVV. 73

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SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

SEP 1

INDIANAPOLIS, IN The Central Indiana Hamfest/Computerfair will be held at the Indiana State Fairgrounds' East Pavilion Bldg. This is brought to you with the help of the Ivy Tech ARC. Open from 8 AM-4 PM. Admission $4 at the door, accompanied children under 12 free. Free parking. Booths with tables $10 ea.; without tables, $5 ea. Advance reservation deadline is Aug 15th. Send payment to ***Central Ind. Hamfest, c/o Leo Doyle KE9TS, PO Box 20158, Indianapolis IN 46220.*** For info call ***(317) 251-9833*** or ***(317) 352-0136.***

SEP 6

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg. starting at 7 PM. Fee for Technician through Extra class tests is $5.25. Talk-in on 147.300. Contact ***John Patchett KB2ERJ, (315) 487-0298.*** Please bring two forms of ID and a copy of your license.

SEP 7

WESTBORO, MA The Minuteman Repeater Assn. will hold the MMRA Flea Market at the Westboro MA High School. Advance tables are $10, floor space $5, before Sep. 5th. After Sep. 5th, tables are $15, floor space $8. Admission $2. Doors open at 8 AM for vendors, 10 AM for buyers. Send table requests and pre-payment to ***MMRA, PO Box 2282, Lexington MA 02173.*** For info call ***A. Morrison N1BHI, (508) 481-3878.***

PORT COLBORNE, ONT. CANADA The Welland County ARC will host a Ham Radio & Computer Flea Market at the Bethel Community Centre starting at 9 AM. Set-up at 7 AM. Admission $3 per person; children 12 and under admitted free. Indoor tables $3 ea. Outdoor tailgaters $1 ea. Ladies bake and craft tables. For info or tables call ***Dave Green VE3EOO, (416) 788-9926*** or ***Tom Nelson VE3PSB, (416) 732-2363.*** Talk-in: 147.30/.90 VE3WCR repeater and 146.52 simplex.

UNIONTOWN, PA The Uniontown ARC, Inc. will hold its 42nd annual GABFEST at the club, located on the old Pittsburgh Rd., just off Rt. 51 and the 119 bypass (40 miles south of Pittsburgh PA). Free parking. Free Swap & Shop set-up with registration. Advance tickets $3 or 2/$5. Talk-in: 147.045/.645 and 144.57/145.17. Contact ***John T. Cermak WB3DOD, PO Box 433, Republic PA 15475. (412) 246-2870*** or ***(412) 246-9383.***

TOPEKA, KS Washburn University, the last municipally owned university in the nation, will sponsor a Hamfest through its radio club, from 9 AM-5 PM in the Whiting Fieldhouse at Washuburn Univ. Admission $3 in advance, $5 at the door. Children under 10 admitted free if with an adult. Swap tables $5 in advance, $7 at the door (includes one admission ticket). Set-up at 7 AM. License Exams. Talk-in: 146.955 -- WVØS repeater. Contact ***Washburn Radio Club, c/o Rob Nall WVØS, 2612 SW Arrowhead Rd., Topeka KS 66614. (913) 272-3559 (evenings).***

ERIE, PA The Radio Assn of Erie will sponsor a Hamfest at Rainbow Gardens, adjacent to Presque Isle State Park. Free parking. Wheelchair accessible. Admission $4. Tables $8 (electricity available). VE Exams at 8 AM at nearby Villa Maria College. Talk-in: 146.01/.61. Call ***Eric N3HUM*** at ***(814) 474-2120,*** or ***Tom N3HPR, (814) 833-1640,*** or write ***RAE, PO Box 844, Erie PA 16512.***

LA PORTE, IN The Michigan City ARC and the La Porte ARC will co-sponsor the La Porte County Summer Hamfest at the La Porte County Fair Grounds. Free parking and free outside Flea Market. Set-up at 7 AM local time. Gate opens to the public at 8 AM local time. Donation $4 at the gate. Tables $5. Talk-in: 01/61, 37/97 or 52 simplex. Contact ***Gene Ward KD9VB, 312 Ash Pkwy., Westville IN 46391. (219) 785-4295.***

WARSAW, IN The American Red Cross ARC of Warsaw, IN, will sponsor the First Ever ARC II Hamfest at the National Guard Armory located 2 miles north of Warsaw. Gates open at 7: AM sharp. Admission is $3.50. Indoor tables are $5. Outdoor spaces are free with admission on first come, first served basis. For info/table reservations, call ***John Sparks, (219) 269-5187, after 3 PM.*** To reserve tickets send check or MO to ***American Red Cross A.R.C., c/o John McClements WB9FIF, 113 15th St., Winona Lake IN 46590.*** Talk-in: 146.985/442.550.

SEP 8

BUTLER, PA The Butler ARA will sponsor their 14th annual Hamfest at the Butler County Farm Show Grounds at Roe Airport from 9 AM-4 PM. Overnight campers welcome. Free outside Flea Market. Indoor vendor's space $10 per 8' table. Admission $1, children under 12 free. Handicap parking available. Mobile check-in till noon on 146.52 (W3UDX) simplex. Talk-in: 147.96/.36 (W3UDX). Fly-in (Butler-Roe Airport) 122.7 MHz. 80/100 Av Gas Avail. Contact ***Chairman WA3BVQ, RD 5 Box 8815, Slippery Rock PA 16057.***

JOLIET, IL The Bolingbrook ARS will hold its Seventh annual Hamfest/Computer Fair at the Inwood Rec. Center beginning at 8 AM. Tickets $3 in advance, $4 at the gate. VE Exams from 9 AM-Noon. Call ***(708) 759-7005*** for info.

NORTHWEST, OH The Findlay Radio Club will host its 49th annual Hamfest at the Hancock County Fairgrounds, beginning at 8 AM. Advance tickets $4, $5 at the gate. Send SASE with your payment to ***FRC Tickets, Box 587, Findlay OH 45839.*** First table $12 (includes admission for 1), additional tables $8 ea. Send SASE with your payment to ***FRC Tables, Box 587, Findlay OH 45839.*** Make checks payable to ***Findlay Radio Club, Inc.*** Talk-in: 147.75/.15 MHz; 449.15/444.15 MHz.

MONETT, MO The Ozarks ARS will hold its annual Club Congress and Swapfest at the Monett City Park (junction of State Hgwy. 37 & US Hgwy. 60) starting at 9 AM. Bingo at 10 AM, pot-luck dinner at 12:30 PM. Talk-in: 146.37/.97 MHz. Call ***(417) 678-3375*** for info.

S. DARTMOUTH, MA The South Eastern Mass. AR Assn will hold their Fourth annual Hamfest/Flea Market from 8 AM-3 PM at the club grounds, 54 Donald St. Admission $2. Table space $8 in advance, $10 at the door. VEC Exams. Talk-in: 147.000/.600 and 145/490/144.890. Contact ***Michael Enos, PO Box 9064, North Dartmouth MA 02747.***

SEP 14

LOS ALTOS HILLS, CA The 1991 Electronics Flea Market, sponsored by the Perham Foundation to benefit the SPECS Users' Group, will be held at Foothill College from 8 AM-2 PM at Parking Lot "C." Please park legally. Buyers free. Sellers $10 per vehicle (2 spaces). For License exam info call ***(408) 255-9000.*** Talk-in: 144.67/145.27 MHz, SPECS repeater.

SEP 15

GAINESVILLE, GA The Lanierland ARC Hamfest will be held from 9 AM-3 PM at the Georgia Mt. Ctr. in downtown Gainesville. Set-up 6-9 AM. Indoor Flea Market only. Tables $10 each. Advance tickets are $4, $5 at the door. FCC Exams at 8:30 AM sharp. Contact ***Rick Coker AB4GS, 5417 Raintree Trace, Oakwood GA 30566. (404) 967-2087.***

BEACH HAVEN, PA The Columbia-Montour ARC will sponsor a Hamfest/Computer & Electronic Fleamarket at the Beach Haven Carnival Grounds, beginning at 8 AM. Free parking. General admission $3, XYL and kids under 16 free. Tailgating area $1 per 8' space, plus general admission. Talk-in: 147.225 or 146.52. Contact ***Dave WC3A, (717) 752-6851*** or ***Fred WB2YTA, (717) 356-7113.***

QUEENS, NY The Hall of Science Hamfest will be held at the New York Hall of Science parking lot at Flushing Meadow Park. Doors open at 9 AM. Set-up after 7:30 AM. Free parking. Donation $4. Sellers $6 per space. Talk-in: 147.195 and 445.175 repeaters. For info call (at night) ***Steve Greenbaum WB2KDG, (718) 898-5599*** or ***Arnie Schiffman WB2YXB, (718) 343-0172.***

CONTOOCOOK, NH The Contoocook Valley RC will sponsor their annual Ham Radio/Computer Electronics Tailgate Flea Market from 8 AM-3 PM. Directions: From Concord NH, take Interstate I-89 North 14 miles to Exit 7, east ½ mile (Rte. 103). Set-up admission $5, general admission $1. Talk-in: 146.895 and 146.94 repeaters; 52 simplex. Info: ***K1QPO @ pkt WA1WOK-2,*** or ***(603) 746-5090.*** eves.

CANFIELD, OH The Twenty Over Nine RC will hold its Hamfest at the Mahoning County J.V.S. from 8 AM-3 PM. Admission $2. Tables available. Contact ***Don Stoddard, 42 S. Whitney, Youngstown OH 44509.***

CAMBRIDGE, MA TAILGATE Electronics/Computer/Amateur Radio FLEA MARKET Sunday Sep. 15th from 9 AM to 2 PM, Albany and Main St., Cambridge, MA. Admission $1.50. Free off-street parking. Sellers $5 in advance, $8 per space at the gate (includes 1 admission). Set-up at 7 AM. Call ***(617) 253-3776.*** Mail advance reservations before the 5th to ***W1GSL, PO Box 82 MIT BR., CAMBRIDGE MA 02139.*** Talk-in: 146.52 and 449.725/444.725-pl 2A-W1XM/R. Sponsored by the MIT Radio Society and the Harvard Wireless Club.

SEP 21

GILBERTSVILLE, KY The Marshall County ARA and Paducah ARA will hold its annual Kentucky Lake Hamfest at the Gilbertsville Elementary School Gymnasium beginning at 7 AM. VE Exams at 9 AM. Talk-in: 146.985 or 147.060 repeaters. Contact ***Kentucky Lake Hamfest, PO Box 534, Benton KY 42025.***

FORESTDALE, RI The Rhode Island Amateur FM Repeater Service, Inc. will hold their annual Fall Auction and Flea Market at VFW Post 6342 in Forestdale (No. Smithfield) starting at 8 AM. Auction from 11 AM-3 PM. Free admission. Flea Market spaces are $5 each. Talk-in: 146.76. Contact ***Rick Fairweather K1KYI, PO Box 591, Harrisville RI 02830*** or call ***(401) 567-0232*** between 7 and 8 PM.

SEP 21-22

GRAYSLAKE, IL The Chicago FM Club will sponsor RADIO EXPO '91 at the Lake County IL Fairgrounds from 8 AM-4 PM. The Flea Market will be open from 6 AM-6 PM. Free parking. Camping. FCC Exams both days. Advance ticket $5, $6 at the gate (good both days). Children under 12 free. Tables are $8 per 8' table per day. Electricity available for $4 per day. For info call ***(312) 262-6773.*** Talk-in on 146.16/.76 MHz repeater (CFMC). To make payments in advance, send payment with SASE to ***CFMC, PO Box 1532, Evanston IL 60204.***

NEW PHILADELPHIA, OH The Tusco ARC will sponsor a Computer/Hamfest in the Monroe Mall, 1260 Monroe St. N.W., Sat. from 10 AM-9 PM and Sun. from 12 PM-5 PM. Free admission. $10 per table. Talk-in: 146.13/.73.

YORK, PA York Hamfest and Computer Show. Inside dealer space. Large tailgating area. FCC Exams. Camping space available. Contact ***York Hamfest, PO Box 351, Dover PA 17315*** for info.

WALLA WALLA, WA The 45th Annual W7DP Hamfest, sponsored by The Walla Walla Valley ARC, will be held from 8 AM-5 PM (Sat. and Sun.) at the Ferndale School Gymnasium near Milton-Freewater OR. Registration/Admission is free. Swap tables are free (for radio gear only, please). License Exams Sun. afternoon. Please bring photo ID, a copy of your license and $5.25. Talk-in: 147.28/.88 repeater. Contact ***Ralph P. Taylor N7DWD, PO Box 321, Walla Walla WA 99362. (509) 525-3002.***

PEORIA, IL The Peoria Area ARC will hold its 32nd annual Hamfest, Peoria Superfest '91 and Computer Show at Exposition Gardens, Northmoor and University Streets. Gates open at 6 AM and doors to the vendor areas open at 8 AM. Free Parking. Wheelchair accessible. Admission $5, good for both days. Features: ARRL Illinois State Convention, VE Exams Sun. at 10 AM (walk-ins welcome). Talk-In: 146.76/.16 MHz. For tickets and info, send SASE with order to ***Peoria Area ARC, PO Box 3508, Peoria IL 61612-3508*** or phone the club answering machine, ***(309) 685-6696.***

VIRGINIA BEACH, VA Tidewater Radio Conventions, Inc. is pleased to announce the 16th annual Virginia Beach Hamfest/Computer Show which will be held at the Virginia Beach Pavilion and Convention Center, Sat. from 9 AM-5 PM, and Sun. from 9 AM-4 PM. Free parking. Radisson Hotel is next door. Gordon West WB6NOA will be the featured speaker. Exhibitors and dealers may contact ***Lewis Steingold W4BLO, (804) 486-3800*** for info and reservations. For tickets and general info contact ***Manny Steiner K4DOR, 3512 Olympia Lane, Virginia Beach VA 23452. (804) 340-6105.***

SEP 22

URBANA, OH The Champaign/Logan ARC Hamfest/Computer Show will be held at the Fairgrounds south of the square on US68. Advance tickets $8, $10 at the door. Set-up at 6 AM. Doors open to public from 7 AM-3 PM. Trunk sales after the tables are sold out. Motels nearby. Talk-in: 147.00+ W8EBG repeater or 147.51 simplex. Contact ***Hamfest Chairman Paul Amerine KC8NM, 168 E. State St., PO Box 185, West Mansfield OH 43358-0185. (513) 355-5352.***

OLD WESTBURY, NY The Long Island Mobile ARC will host a Hamfest at the New York Institute of Technology, Old Westbury Campus, from 9 AM-4 PM. Tickets $5 at the gate. Exhibitors $10 (no advance). Contact ***Neil Hartman WE2V, (516) 462-5549*** or ***Mark Nadel NK2T, (516) 796-2366.*** Talk-in: 146.25/.85.

DANBURY, CT The Candlewood ARA will sponsor a Flea Market at the Elk's Club, 346 Main St. from 8 AM-3 PM, table set-ups at 7 AM. Admission $4, kids under 12 free. Tables $8, tailgating $6 (includes 1 admission). For reservations: ***C.A.R.A., c/o Bob Elton, 60 Padanaram Rd., #18, Danbury CT 06810.*** For info call ***(203) 790-7987*** or ***(203) 426-1652.***

SEP 27-29

SAN JOSE, CA The 10th Annual ARRL Computer Networking Conference will be held at Radisson Airport. Contact ***Glenn Tenny AA6ER, Fantasia Systems, Inc., 2111 Ensenada Way, San Mateo CA 94403. Voice (415) 574-3420; Fax (415) 574-0546; UUCP/Internet: tenneywell.sf.ca.us; CompuServe: 70641,23.***

SEP 28

VANDERBILT, MI The Northern Michigan Chain of Clubs will sponsor its second annual Hamfest at Vanderbilt School (I-75 to exit 290 E), from 8 AM-2 PM. Set-up at 6 AM. Admission $3 in advance, $4 at the door. Dealer tables $5. Flea Market tables $4. For walk-in VE Exams, bring your original license and a photocopy. Talk-in on 147.120 repeater. Contact ***Bob George W8PIC, PO Box 173, Oden MI 49764-0173.*** or call ***Denny, (517) 732-9539*** or ***Tim, (517) 826-5549.***

WARSAW, IN The American Red Cross ARC of Warsaw IN will sponsor the First Ever ARC II Hamfest at the National Guard Armory located two miles north of Warsaw. Gates open at 7:30 AM sharp. Admission $3.50. Indoor tables $5. Outdoor spaces free with admission on a first come, first served basis. For reservations or tables call ***John Sparks, (219) 269-5187 (after 3 PM).*** For advance tickets, send check or MO to ***American Red Cross A.R.C., c/o John McClements WB9FIF, 113 15th St., Winona Lake IN 46590.*** Talk-in: 146.965, 442.550.

SEBASTOPOL, CA The 9th annual SCRA Ham Radio Flea Market and Auction will be held at the Holy Ghost Hall, 7960 Mill Station Rd., from 8 AM-2 PM. Free admission, free parking. Set-up starts at 7 AM. Advance tables $10, $12 at the door. Talk-in: 146.13/.73. Contact ***Sonoma County Radio Amateurs, PO Box 116, Santa Rosa CA 95402. (707) 523-1001 days; (707) 526-2198 eves.***

SEP 28-29

LOUISVILLE, KY The Greater Louisville Hamfest will be held at the Commonwealth Convention Center, downtown Louisville. Advance tickets $6 with SASE; $8 at the door. Commercial and Flea Market spaces available. Mail ticket requests to ***The Greater Louisville Hamfest Assn., PO Box 34444-S, Louisville KY 40232-4444.***

SEP 29

PASCO COUNTY, FL The Suncoast ARC will hold the First Pasco County FL Hamfest at the New Port Richey Rec. Center from 8:30 AM-3:30 PM. A W5YI testing session will be conducted. An ARRL awards manager will be present to verify OSL cards for awards. Admission is $3 at the door, children under 12 admitted free. Sellers $5, pre-registration requested. Tables are available for rent. Contact ***Suncoast ARC, PO Box 7373, Hudson FL 34676,*** or ***Ralph N4QIK, (813) 847-4043.***

YONKERS, NY Metro 70cm Networks' Giant Electronic Fleamarket will be held at Lincoln High School on Kneeland Ave. Free parking. No tailgating. 9 AM-3 PM rain or shine. VE Exams 10 AM-2 PM. Admission $4; kids under 12 free. Set-up at 7 AM. First table $15, $10 ea. additional table. All tables 30" x 5'; or bring your own table at $1.80 per foot, min. $10. Full payment is due with registration before Sep. 20th. No refunds unless notification of cancellation has been received 72 hours in advance. All tables $20 at the door–$2.50 per ft. Contact ***Otto Supliski WB2SLQ, 53 Hayward St., Yonkers NY 10704. (914) 969-1053.*** Talk-in: 440.425, 445.425T, PL 156.7HZ, 146.910R/146.310T, 223.760R/222.160T PL 74.4.

CLEVELAND, OH The Cleveland Hamfest/Computer Show will be held at the Cuyahoga County Fairgrounds in Berea, OH (a few miles south of Cleveland Hopkins Int'l. Airport) from 8 AM-4 PM. Set-up at 6 AM. Talk-in: 146.73/.13 from 6 AM-Noon. VE Exams walk-in at 2 PM. Contact ***Ed Stevens WB8ROK, 18607 Fairville Ave., Cleveland OH 44135-3915. (216) 267-5473.***

LONGMONT, CO The Boulder ARC will sponsor BARCFest '91 at the Boulder County Fairgrounds Exhibit Bldg., from 8 AM-2 PM. (Twin Peaks Shopping Mall is just across the street.) VE Exams. Admission $3 per person. Tables $10 each. Make checks out to ***Boulder ARC,*** with SASE to ***Kim Elmore N5OP, 1103 South Gay Dr., Longmont CO 80501.*** Or leave a message at ***(303) 530-2903.***

ADRIAN, MI The Adrian ARC will hold their 19th annual Hamfest/Computer Show at the Lenawee County Fairgrounds from 8 AM-2 PM. Advance tickets $3, $4 at the gate. Inside tables $6/8'; trunk sales $3/8'. VE Exams. Talk-in: 144.770/145.370 (input/output). Info and reservations from ***Dennis Boydston WE8Z, 2383 E. Clearview Dr., Adrian MI 49221. (517) 265-8054*** after 4 PM EDT.

SPRINGFIELD, IL The Sangamon Valley RC will hold their New Berlin Hamfest from 8 AM-1 PM at the Sangamon County Fairgrounds in New Berlin. VE Exams. Flea Market. Tickets $3. Indoor tables $10. Talk-in: 146.805 - .600. Contact ***SVRC, PO Box 8252, Springfield IL 62791. Don WD9EBK, (217) 789-4519.***

SPECIAL EVENT STATIONS

SEP

VERMONT Throughout the coming year Special Event Stations in Vermont will operate 25 kHz up from the bottom of the Novice and General band, to help celebrate Vermont's 200th Anniversary RTTY/AMTOR/etc. will be in the digital sub-bands. For a special certificate send $1 and a SASE to ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.*** Foreign stations send only SAE and IRC's to cover postage.

SEP 1

SCHAUMBURG, IL The Schaumburg ARC will operate WB9TXO 1500-2100 UTC, from their Demonstration Station at Schaumburg's Annual Septemberfest. Frequencies: 7.291, 14.291, 21.291, 28.391. For special certificate send OSL ,to ***SARC, PO Box 68251, Schaumburg IL 60168-0251.***

SEP 6-8

PUT-IN-BAY, OH Members of the Oliver Hazard Perry Expeditionary Force will operate KB8BN from Perry's Victory and International Peace Memorial, to commemorate the 178th anniversary of the Battle of Lake Erie. The celebration of Perry's victory, and continuing Canadian/American Friendship, will be marked by the return of the restored US Brig Niagara, Commodore Perry's relief Flagship. KB8BN will begin operations at 2100Z. Frequencies: 28.365, 21.365, 14.265, 3.965 MHz. For a commemorative certificate, please send a QSL and large 9X12 SASE to ***Commodore Don Wills, 30372 Bates Rd., Perrysburg OH 43551-3832, USA.***

SEP 9-14

ATLANTIC CITY, NJ Southern Counties ARA will operate K2BR, beginning at 9 AM EST, from the Miss America Pageant in Atlantic City. Atlantic City is located on Absecon Island, which is Iota: NA111. Frequencies: Phone-25 kHz inside lower General class band edge. CW-65 kHz inside lower General class band edge. Novice-28.100/.500 MHz. QSL with #10 SASE via ***SCARA, PO Box 121, Linwood NJ 08221.***

SEP 14

WARSAW, IN The American Red Cross will operate a Special Event Station from 7 AM-4 PM. Frequencies: 15 kHz up from the bottom of General and 28.450± 10 kHz. Send QSL card and SASE to ***KB9AVT Ron Eflinger, Rt. 5, Lendonway Terr., Syracuse IN 46567.***

SEP 14-15

PINE GROVE, CA The Amador County ARC will sponsor Station W6PI as part of the Amador County Gold Country Jubilee from 1700Z-0500Z each day, with SSB on the first half hour and CW the second half hour. Frequencies will be in the lower 25 kHz of the General subbands and the Novice/Technician 10 meter subband. For a commemorative QSL, send your OSL and an SASE to ***ACARC, PO Box 1094, Pine Grove CA 95665.***

SEP 15

SAN JOSE, CA The West Valley ARA will operate Station W6PIY to commemorate the club's 35th Anniversary. W6PIY will be portable from a local park and can be worked on CW-14055, 21120, 28120; or SSB-14250, 21350, 28450, from 1600-2200 UTC. For commemorative certificate, send a SASE to ***W.V.A.R.A., PO Box 6544, San Jose CA 95150-6544.***

SEP 21-22

MONMOUTH COUNTY, NJ The Ocean-Monmouth ARC will operate KC2Q, from 1600Z Sep. 21st-1600Z Sep. 22nd, from the historical Twin Lights Lighthouse. This event commemorates the first commercial use of wireless transmission by Marconi in 1899 from this exact location. Frequencies: 3.970, 7.270, 14.270, 21.370, 28.470. 8½ x 11 certificate available via ***OMARC, PO Box 357, Bradley Beach NJ 07720.***

SEP 27-29

PEA PATCH IS., DE The Tristate IRC will operate KD3XN from historic Civil War, Fort Delaware, on 10, 12, 15, 17 and 20 meters. Operators will be N3EMY, N3IGK, N3ISR, and KD3XN. For QSL please send SASE to operator worked.

YORK, PA The Hilltop Transmitting Assn. will be operating KA3TFI or WF3T in celebration of the 88th year of Harley-Davidson Inc. Operation on CW and SSB, 80 thru 10 meters, from 1400Z-0400Z. Frequencies: Novice 10 meters and General subbands SSB and CW. The stations will operate from the test track behind Harley-Davidson's final assembly plant in York PA. For certificates send QSL and SASE to ***KA3TFI, RD #6 Box 119, Circle Dr., Red Lion PA 17356.***

KINGWOOD, WV Preston County amateur radio operators will operate WM8E from 1400Z Sep. 27th-0200Z Sep. 29th, in celebration of the 50th annual Preston County Buckwheat Festival. Modes will be phone or CW on 40, 20, 15 and 10 meters, approx. 25 kHz up from the bottom of General phone bands or Novice CW bands. For certificate, send QSL and SASE to ***John Wills KE8NO, 104 Swartz Rd., Kingwood WV 26537.***

SEP 28-29

BRANCHVILLE, SC The world's oldest railroad junction will host Station AD4U as the Edisto ARS celebrate their Second annual coverage of the RAYLRODE DAZE FESTIVUL. AD4U will operate 14.285, 21.375, and 28.400 MHz± and area 2m repeaters from 10 AM-10 PM EDST on Sat., and 1PM-6PM EDST Sun. For a distinctive 8½ x 11 certificate, send QSL and SASE to ***AD4U, PO Box 2045, Orangeburg SC 29115-2045.***

Number 25 on your Feedback card

UPDATES

Allderdice Students Contacted the Atlantis

In Philip Chien's article, "The Flight of STS-37" in the June 1991 issue of *73*, the list of schools contacting the shuttle *Atlantis* was incomplete.

The students at Reizenstein Middle School in Pittsburgh joined the students at Allderdice High School in Squirrel Hill, Pennsylvania, to use the Allderdice High School ham station. Reizenstein Middle School was mentioned in the article, but Allderdice High School was not.

Operating with the callsign W3BMW belonging to Allderdice teacher Ed Karsin, students from both schools were able to experience the thrill of contacting the shuttle.

We apologize to Ed and the students of Allderdice High School for omitting them from the list of schools.

OMIK Inquiries

See the information on OMIK, submitted by Ocran M. Carr K9RGV, on page 8 in "QRX" of the June 1991 issue. If you would like to know more about OMIK, contact OMIK's secretary: Thomas A. Spight, P.O. Box 805, Racine WI 53403.

QRP Column Correction

In last month's "QRP" column (August 1991), there was an error in the PC board foil pattern and parts placement for the pulse charger circuit. The in and out pins of the optional LM317K device were reversed. Note, however, that the circuit will work if you use the LM317T device instead. Figures 1 and 2 show the correct foil pattern and parts layout.

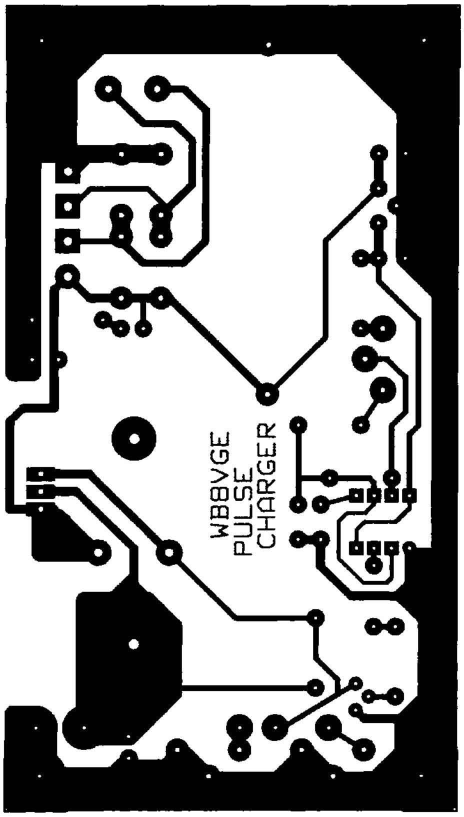


Figure 1. Corrected PC board foil pattern for the pulse charger (August "QRP" column).

VK3 QSL Bureau Alive and Well

In the April 1991 "DX" column, a statement was made that the VK3 incoming QSL Bureau would no longer take cards. Apparently this message was the result of a prank (or worse). According to the Wireless Institute of Australia, the VK3 QSL bureau is alive and well and can accommodate all incoming QSLs destined for the area. 73

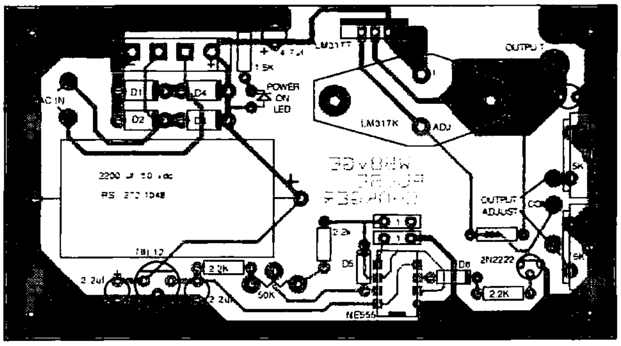


Figure 2. New parts placement for the pulse charger.

Number 26 on your Feedback card

QRP

Low Power Operation

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

Home-Brew Tuner for QRP

Antenna tuners *are easy* to build. But, I've always had the notion you could buy one cheaper than you could build one. Unless you have a very large junk box stocked with wide-spaced variable capacitors and roller inductors, you have to purchase all the parts new. Have you looked up the price of a roller inductor recently? Talk about the national debt!

Even though you can't really beat the roller inductor for getting the precise amount of inductance, they're hard to mount. They also require a logging scale of some sort so that you can re-tune to the same spot if you change bands and come back later.

Running QRP, we have the option of using a rotary switch to select the inductance as *needed*. To a point, RF breakdown of the components is not a factor at QRP power levels; the tapped coil is not as accurate as the roller inductor, but it will work just fine.

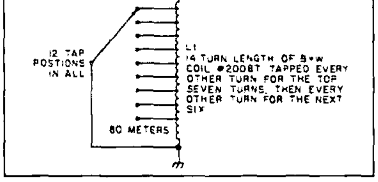
We'll need some type of chassis to house this project. To this day, I don't enjoy pounding holes in metal, let alone bending the stuff into a chassis. Radio Shack once again comes to the rescue with a project box, RS 270-274, for about ten bucks. A good value if you include all the suffering you'll save yourself by buying it. Don't use a plastic box.

The circuit is a classic antenna tuner. Nothing fancy. The fancy work will come in with mounting the parts. Some of the parts may be hard to find. This is not a jump-in-the-car-and-go-get'em project. However, I do have several sources for most of the parts.

Coil and Switch

The hardest part to come up with is the coil. I used B&W 2008T coil stock for the antenna tuner. The coil form is 14 inches long, of which you'll only need about 1-3/4 inches. Here is your chance to stock up the junk box or to make this a club project and use up the whole coil. Those of you who are stout of heart could wind your own, but the B&W is a lot easier!

Next on the shopping list is a switch to select the inductor's windings. Radio Shack sells a 12-position switch like the one we need, but it is a NON-shorting switch. This means that the switch opens before it closes. If you move the inductor switch while you have RF flowing into the tuner, you'll *end up with burnt contacts!*



For QRP, a tapped coil antenna tuner will work fine.

A good switch to use (surplus might be a good place to start looking for this switch) is a Centralab CTS T201. It's an 11-position, make-before-break rotary switch.

Cap Details

Both 360 pF capacitors are standard broadcast type. These are easy to come by. The capacitors MUST be insulated from ground. This includes the capacitors' shafts as well. I used some 1/4-inch thick plastic that I found in the junk box. Two screws hold the capacitor to the plastic, and two more screws hold the plastic/capacitor combination to the chassis. Both capacitors are mounted in this fashion.

You might want to raise the height of the capacitors a bit. Too low and you'll have trouble getting the knobs on, too high and you'll have trouble getting the top of the chassis on. Plan ahead before you get the drill spinning!

Keeping the shaft above ground proved very interesting. I did have some old ceramic couplers lying about in the junk box. They proved invaluable. Lacking these, plastic couplers can be fashioned. Drill out a 1/4-inch hole from round, 3/4-inch thick plastic stock and add self-tapping screws, one for each shaft. The screw will hold the shaft to the coupler. The homemade coupler need be only 1 inch long. If you can't find 3/4-inch round plastic, try a maple dowel. Seal the wood after you're done, to keep moisture out.

You'll also need some 1/4-inch plastic or nylon. A good place to get this is the local hobby store. Steel would be all right, too, but plastic is easier to work with. If you really want to get fancy, a panel bushing would be grand! It gives the entire project a good solid feel when tuning the capacitors. If you have some old pots, these can be disassembled and used for panel bushings. The newer ones won't work. Remember when everyone laughed at you when you brought the dead DX-100 for ten bucks? Well, there has to be half a dozen panel bushing in one of those boat anchors. Who's laughing now?

Solid Connections

The most cumbersome work in building this project was attaching 12 wire jumpers from individual turns on the coil to terminals on the switch. Here's how I did it. Starting at the left end of the coil (the 10 meter end), tap every turn through the 7th turn, and then tap every other turn. Just be sure that the last tap is on the last turn, for 80 meters. Since we're not launching missiles, don't sit up at night worrying about whether you got the tap in exactly the right place or not.

You'll need some rather heavy wire to connect the two capacitors and the switched inductor. I used a small length of #12 house wire after removing the plastic insulation. Soldering should be done with a rather large soldering iron or gun. Use lots of heat to avoid cold solder joints. However, be careful not to overheat the B&W coil, as the plastic ribs will melt.

I used standard SO-239s for antenna connections. Don't cheat and use junk for connectors. Get the good ones with the Teflon™ centers and silver plating. Get the best you can afford. Nothing like trying to save a buck, only to have it come back and bite you.

Even though there are only a handful of connections, be sure they are good and solid. To ensure a good ground, scrape away any paint on the chassis when you mount the SO-239s.

The Least for the Most

There is little to adjust or tune. If you assembled the tuner following the schematic, and insulated the two caps, it should fire right up. Remember, use the least amount of inductance for the best power transfer.

To use the antenna tuner, connect the transceiver and the antenna to their proper connections. You'll need an SWR bridge if your rig does not already have one built in. Set both capacitors at midway, then adjust the inductance control for the highest noise level in the receiver. Apply some RF, and watch the SWR meter. While watching the meter, adjust both capacitors, one at a time.

At some point the SWR will dip down. Add more RF if necessary to ensure an accurate SWR reading. Adjust both capacitors for lowest SWR. If you can't get a match, move the inductor switch up or down one position and try the capacitors again. At some point, you'll find the correct combination and get an SWR of 1:1. If you're not planning on running QRP, remember that the power level is determined by the spacing of the capacitors, the switch, and of course, the coil. With stock parts, don't use more than 200 watts of RF into the *tuner*.

This tuner is for use with antennas fed by coaxial cable. It won't work with random wire or 300 ohm twin-lead. A tuner does not change the SWR of the antenna; it merely provides the correct load for your transmitter. In my case, it allows me to operate SSB on a dipole cut for CW. The SWR is too high in the phone segment of the band on my 20 meter dipole. The tuner is not a magic cure for the wrong antenna!

That's all there is to this project. Most of your time will be spent trying to get the parts. Antenna tuners *are not easy* to build without the correct parts. As I mentioned early on, I have a source of parts for this project, several sources to be exact. (See the list of parts suppliers.) Besides the hamfest and your friend's junk box, try Surplus Sales of Nebraska. They have the capacitors as well as the B&W coil. Also try Radio Kit.

Here's an unexpected source of parts for the tuner: Ten-Tec. Yup! They sell the tapped inductor from their smaller antenna tuner. This part has more taps than specified above for the tuner, but it works great! They also have a good supply of variable capacitors and insulated shaft couplings. You might even get some panel bushings as well.

Enjoy your project. Next month we'll take a close look at portable packet operation, QRP style. ■

Parts Suppliers

Ocean State Electronics
P.O. Box 1458
Westerly RI 02891
Tel. (800) 866–6626 (orders);
(401) 596–3080; Fax: (401) 596–3590

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Tel. (603) 635–2235

No minimum ($3 service charge if under $20), many kits, lots of J.W. Miller chokes and coils, B&W coils, RF switches, Millen variable capacitors, lots of parts in general. Send $1 for their catalog.

BCD Electro
P.O. Box 450207
Garland TX 75045-0207
Tel. (214) 343–1770

$1 for 1-year subscription to catalogs; no minimum; $0.95 for under $30, $2.90 shipping. Surplus electronics, pretty random looking assortment.

Surplus Sales of Nebraska
1315 Jones Street
Omaha NE 68102
Tel. (402) 346–4750

New and surplus radio electronics. Wide selection; lots of Collins stuff.

KA7QJY Components
Box 7970
Jackson WY 83001
Tel. (307) 739–1634 evenings

Send a business-size SASE for a current list of parts. RF parts, including vernier drives and air variables. $2.75 shipping, no minimum.

Oak Hills Research
20879 Madison St.
Big Rapids MI 49307
Tel. (616) 796–0920

This is Doug DeMaw's old outfit, now run by Dick Witzke KE8KL. Dick has also purchased Small Parts Center's line of kits and parts. Catalog is $1.00; product line has been greatly expanded with new kits, components, antennas, and many hard-to-find items, including new USA manufactured air variable capacitors, vernier drives, and roller inductors. "Everything" for the diehard home-brewer/QRPer.

Number 27 on your Feedback card

73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I am finding it very interesting in this job to see the increased communications coming out of countries that in the past have been closed and controlled. It does my heart good to see these things. Even though I have not had as much time to get on HF as I would like, I hope that others have been taking advantage of these changes.

Solar flares last June made amateur communications difficult, though not impossible. My HF packet traffic back and forth to Ron Gang 4X1MK in Israel seems to make it fine. I put my message on a local packet board here in New Hampshire, and usually within a day it arrives at a packet board near Ron. And most of the DX nets are still prospering.

Before we get to the news from around the world, I would like to make a correction to the July 1991 "Notes from FN42" in which I said that we would find out what Box 88, Moscow, was like thanks to Ron Gang 4X1MK. Ron was just the messenger; Oded Schremer 4X4SO provided the information. Thanks, Oded.—Arnie, N1BAC.

Roundup

Japan From *The JARL News*: From April 8–13, an Amateur Radio Administration Course was held at the Iikura Annex of the Ministry of Posts and Telecommunications, Tokyo, under the combined auspices of the International Telecommunication Union (ITU), the Japanese Ministry of Posts and Telecommunications, and JARL, and also with the cooperation of the International Amateur Radio Union (IARU) and the Telecommunication Advancement Foundation in Japan (TAF).

The main purpose of the international seminar was to contribute to the development of telecommunications in each country through the promotion of orderly development of amateur radio. The last time such a seminar was held in Japan was four and a half years ago. This year, 17 government officials from 17 different countries of the Asian and Pacific Regions participated, all of them representatives of countries where amateur radio operation has only just started or is not sufficiently developed.

Countries participating in the seminar were India, Indonesia, Kiribati, Singapore, Sri Lanka, Solomon Islands, Thailand, China, Tonga, Western Samoa, Nepal, Pakistan, Fiji, Philippines, Bhutan, Vietnam, and Malaysia.

U.S.S.R. From Alex Barinov UA3DCZ: "Within the frames of preparation and carrying out the Orthodox-Christian Cultural Program '600 Years of Saint Sergius's of Radonezh Death' which is conducted in 1991–1992 by the Soviet Cultural Fund, the Saint Sergius of Radonezh Brotherhood will operate from October 5–13, 1991 under the special callsign R3DSR. It will be a radio expedition-marathon devoted to the 650 years of the Saint Trinity-Sergius Monastery that was founded by Sergius of Radonezh, the great churchman and statesman of ancient Russia.

"The radio expedition-marathon is organized by the youthful sports and technical club 'Energy' from Zagorsk, the group of radio amateurs 'Kivach' from Petrozavodsk, the group 'The Union' from Orsk, and the club of collective radio stations from Omsk.

"We will be listening for all amateurs on all bands, both HF and VHF. Radio amateurs and SWLs who establish the most number of contacts and observations on different bands, and radio amateurs younger than 18 years of age, will be awarded special prizes of the Saint Sergius of Radonezh Brotherhood in Zagorsk.

"Send the account with the information about the owner of the radio station not later than November 1, 1991, your QSL for R3DSR, and your suggestions to: Alex Barinov UA3DCZ, Box 4, Zagorsk, 141300, Russia, USSR.

"By establishing radio communications with R3DSR and the radio amateurs of the town of Zagorsk, you can fulfill the requirements for winning the pendant 'Sergius of Radonezh,' the award for 650 Years of the Saint Trinity-Sergius Monastery."

From Igor V. Suprunov UA9MFW: "The West Siberia Collector's Club (WSCC) is for everybody who is collecting anything." Igor UA9MFW is president/founder of the WSCC (and an aircraft plastic model kits fan). Using a home-brew computer and simple printer, Igor and his wife (UA9MLW, a model car collector), and their friends, publish a bi-monthly bulletin, "WSCC Round Table."

You can receive the "WSCC Guide" (for radio amateurs), including membership rules, awards program, and members list with their addresses and collecting interests by sending an SASE with 4 IRCs or 2 green stamps to Igor V. Suprunov, P.O. Box 3360, Omsk, 644020, USSR. Please seal your envelopes carefully. *[Igor sent a copy of the rules for 14 awards given by WSCC. It is too lengthy to include here, but it will be put on the 73BBS (603-525-4438, 300, 1200, or 2400 baud, 8-N-1). The information also lists the callsigns of 40 members of WSCC.—Arnie]*

Photo A. The URE/URL clubhouse and antennas in Las Palmas, Canary Islands.

Photo B. QSL card of UA3DCZ showing the Saint Trinity-Sergius Monastery.

KENYA

Rod Hallen 5Z4BH
AMEMBASSY Box 55A
APO New York 09675

After four years in Nairobi I have received an assignment to Karachi, Pakistan. I hope to receive a callsign there, but there is no guarantee. Callsigns are hard to acquire. I am to leave here sometime late next year and will be in AP2 country for two years.

The Radio Society of Kenya (RSK) has been working on reciprocal licensing agreements for the past year. The U.S. agreement is in the final stages; agreements for Germany and the U.K. are also in progress. All the details are not in yet, but I will pass them on when they become available.

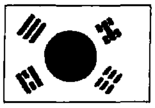
The RSK is planning a Field Day 13–14 July, so look for us. The callsign will be 5Z4RS/A. We are also considering a QSO Party sometime in the fall. One of the purposes of these activities is to promote the Kenyan Award. This attractive award is available to any amateur operator who works five 5Z4 stations who are members of the RSK. The club station, 5Z4RS, counts as two contacts. A certified list of contacts is all that is required, no QSLs.

The award costs $8 or 15 IRCs. The application with certified log data should be sent to the Awards Manager, Radio Society of Kenya, Box 45681, Nairobi, Kenya. Registered mail is suggested but not required.

An interesting sidelight to this award is the fact that most of Kenya's DXers are in regular communications with each other via 2 meter repeater or simplex. Whenever one of us contacts a station that is interested in the award, it is usually possible to get enough members on frequency to fulfill the requirements all at once. By the way, there is usually one or more 5Z4s in contact with John W4FRU on any Tuesday at 1900Z on 21.220 MHz.

The RSK has also recently become very interested in satellite communications. Although we somehow missed the shuttle with its all-ham crew, we have been making up for it by working the Russians. Six of us have made contacts with U2MIR, U5MIR, or RS-11. I talked to Serge U5MIR on June 4, and we were able to have a QSO that lasted about four minutes. On a direct overhead pass he should be good for 10–12 minutes. He says he will be up there until October!! All of this with a 20 watt, 2 meter mobile with a ground plane antenna. *[But OH what a tall tower for that ground plane!—Arnie]*

Many of us have computers and satellite tracking software, so we always know when and where to look. We also have two members with fully functional OSCAR 10/13 stations.



REPUBLIC OF KOREA

Byong-joo Cho HL5AP
PO Box 4, Haeundae
Pusan, 612-600
Korea (South)

The Korean Amateur Radio League's (KARL) three portable stations: HL8A, HL8N, and HL8V, have used special calls during the past CQ Worldwide Contest operating from 78-1, Non Hyun Dong, Kang Nam-Ku, Seoul, Korea. These special callsigns were requested by KARL and the Ministry of Communication issued them for use during the International DX Contest.

Hereafter, KARL shall use D73A, D73DX, and D73CW in every international contest. HL8A = D73A; HL8N = D73DX; and HL8V = D73CW.

There will be three amateur examinations given this year. There are four different class licenses: 1st Class, 2nd Class, 3rd Class CW, and 3rd Class Phone. There will be examinations at eight different locations. The summary as of 15 May is: 2971 examined and 2224 passed for a 75% pass average. *[The most popular appears to be the 3rd Class Phone with 2773/2086.—Arnie]*

SAUDI ARABIA

Charles Martin
PO Box 2830
Dammam 31461
Saudi Arabia

Salaam Aleikum! I have arrived in Saudi Arabia and hope to bo able to report on some of the happenings here and in the surrounding area. If there are any hams in the country or nearby area who have information for inclusion in "73 International," I would appreciate it if you would send it to me. 73.

Say you saw it in 73!

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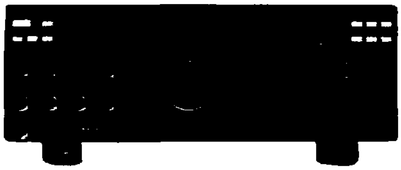

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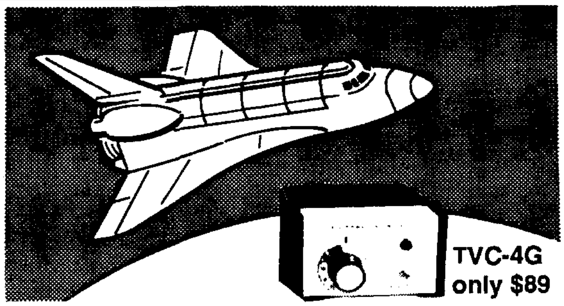

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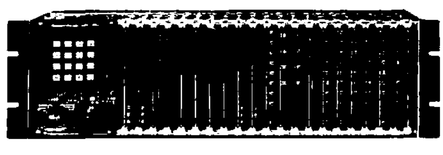

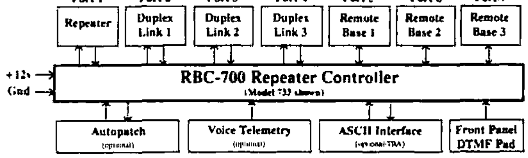

The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

Several models are available and are software configurable to support up to 3 Repeaters, 5 Duplexed Links, and 4 Remote Bases. A group or club can start with the basics and expand their controller anytime by simply adding boards and software. Free software upgrades for one year after delivery. Finally, a real controller for the Linked system operator !

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Up to 5 Duplexed Links	Intergrated Autopatch
Up to 4 different Remotes	Expand at any time
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Programmable Macros	+ 10v to + 14v Supply
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HAMS WITH CLASS

Carole Perry WB2MGP
P.O. Box 131646
Staten Island NY 10313-0006

Men in Blue with Rigs

Several years ago I had the pleasure of meeting Jeff Savasta KB4JKL at the Boxboro Ham Radio Convention in Massachussetts. Jeff is a police officer with the Suffolk County Police Department in Long Island, New York. He was intrigued with the stories I told him about using amateur radio as a motivational tool for youngsters in a classroom. Police personnel have always been very supportive of my program. They are in a position to understand how important it is to interest young adults in worthwhile activities.

I really believe that a major cause of teenagers getting into trouble today is that they don't have the skills necessary to pursue interests that are challenging to them. The police officers in our area know that the children who are involved with the ham radio activities at our school have always been an asset to the community. They participate in many neighborhood events, and are among the first to volunteer when communications are needed.

One of the trips I take my ham radio classes on is to the New York City Police Academy. The communications network they use is very impressive to the children, and helps them understand the importance of clear and succinct messages in times of emergencies. It seemed perfectly natural, therefore, to invite Jeff to speak with the children at my school. I'm always on the lookout for hams with interesting backgrounds to be guest speakers for my classes at Intermediate School 72 in Staten Island. New York. As an instructor, I know how important it is to have not only an interesting person, but also a person who can convey enthusiasm and speak appropriately to the age level of the audience.

The kids were immediately attracted to his uniform and all the "goodies" he wore on his belt. If you invite police officers to visit your classroom, try to persuade them to appear in uniform. Children react well to that. My radio classes were fascinated with his stories about the importance of radio communications in his line of work. He also came prepared with a video that showed how an officer was killed because someone was fooling around and jamming the police frequency. The fact that Jeff is a ham radio operator himself gave special credence to his presentation about how to phone in an emergency. The children felt really special when he told them that the police are especially responsive to calls that come in from hams because they know that hams tend to be responsible and reliable in reporting accidents or other kinds of emergencies that require police intervention.

Jeff's visit to my school was only the beginning of a wonderful ongoing relationship with the children in the radio program. He was soon invited back and made another excellent presentation. The great goodwill a policeman visiting the classroom can generate should not be overlooked. It is extremely important for today's youth to have respect for the fine police officers who risk their lives every day for all of us. Everyone benefited from the contact.

I was especially pleased when Jeff told me he was involved in starting up a police amateur radio club. I hope the following account which he wrote for me will serve to inspire as well as to educate others who are thinking of starting a similar group.

Jeff Savasta KB4JKL Speaks

When I decided to undertake the starting of the Police Amateur Radio Club, I didn't realize what a major task this would be. If this club were being formed by people who work a nine-to-five day, it would probably have been easier. When members work different shifts, it's more difficult to get together.

The Suffolk County Police Department is a major metropolitan police department in a tri-state area. With 2500 sworn personnel and numerous civilian employees, there is a fair population of hams within the structure. Years back, there was an attempt to form an amateur radio club, but it never made it off the organizational level. I wanted to make sure that we would be successful.

At first it was a lonely endeavor. The questions that went through my mind were never-ending. There was a lot of doubt and anxiety about laying the cornerstone of this venture. "Where or how do I start?" I asked myself often. "And when I do, what type of response will I get?"

Then, one day in November 1989, as I walked into my precinct to report for work, I noticed an individual speaking into a microphone in a foreign vehicle next to the detective squad entrance. Curious, I got closer. As I neared the vehicle, I saw a 140–150 MHz VHF antenna on its roof. The individual inside the vehicle was talking on a 2 meter transceiver.

It felt good to see another ham inside the police complex, and it felt even better to realize that he was another cop. That was the first time that I met Detective Doug Lotten N2JHO of the arson squad. I introduced myself, and an immediate bond took place, one which always happens when two hams get within 50 feet of each other. I discussed my idea of a police amateur radio club with him, and he thought it was a great idea. It was comforting to get the perspective of another amateur radio operator who is also a professional peer. We went through the ideas we both had about getting things started.

The first thing I thought we should do was get the idea reviewed and approved by the upper bureaucracy of the department. I composed an internal correspondence in February 1990, and we began the waiting process that so often occurs in large organizations. Finally, in June 1990, after being reviewed also by the department's legal bureau, it was approved by the Police Commissioner.

The perfect way to reach out to our peers was through the departmental newspaper. We wrote an article about the club and got responses. Then we put together a club constitution which took us approximately two weeks to complete. I established a preliminary list of five members and applied to the ARRL for club affiliation. We were approved, and became an affiliated organization in November 1990.

I then decided to put out a makeshift newsletter for the amateurs and nonamateurs Doug and I had talked with in the department. We were surprised at how fast word-of-mouth had spread the club idea. I am a firm believer that hams find other hams, as we are definitely a community within communities, not only in the police structure, but in everyday public life.

In January we had our first meeting. It was plain that because of our different schedules, we wouldn't be able to all meet at the same time. We did have enough members present to carry out club business and hold elections. I was elected president; Doug, vice president; Roy LoBocchiaro KB2KOP, treasurer; and John Isbell KE2TC, secretary. John also took charge of the monthly newsletter and the logo on the letterheads.

We've sparked the interest of the nonamateurs in our department, and are becoming their elmers. We've also received favorable response from the non-police amateur community. Many local clubs have offered their assistance and use of club repeaters. We have been very pleased by this; I don't think many amateurs here in the Northeast are used to seeing the police involved in amateur radio. According to club Secretary John KE2TC, police involvement in amateur radio is more common in other parts of the country, such as the Midwest.

On a personal note, I've been to the class of Carole Perry WB2MGP at I.S. 72 in Staten Island, New York, to speak to the students about amateur radio, and on how police radio operation is similar. Most of the children in the class are intrigued and impressed by the police, as they are at a very impressionable age, and I feel that I should be the best ambassador I can be for amateur radio. Many students will remember their experience, and walk away feeling positive about themselves and amateur radio. I feel that we should all be the best ambassadors of amateur radio that we can be, both in the police and non-police sectors, as amateur radio has given us so much enjoyment and service.

Our club hopes to benefit its members and serve the public, goals all amateur clubs strive to achieve. Though amateur radio operators may come from different walks of life, we are all bound together by a common bond.

If any of you would like to write me or the club with questions and comments, address your letter to: S.P.A.R.C., %Suffolk County Police Dept., 30 Yaphank Ave., Yaphank NY 11980. *[Please also enclose an SASE.—Eds.]*

Photo A. Left to right: Detective Douglas Lotten N2JHO, Arson Squad, and Officer Jeffrey Savasta KB4JKL. A fortuitous meeting leads to a new ham club.

Never Say Die

Continued from page 4

the regular meetings? License classes? Code classes? By the way, I'm getting piles of letters from new no-coders and virtually every one is enthusiastic about learning the code to get a General ticket. I haven't seen any FCC figures yet showing the increase in hams due to the no-code ticket, but just judging from my mail, it's gotta be encouraging.

I'm hearing from more and more clubs who have been running license classes and graduating new Novices and Techs. My answer to each such letter: Prove it! Send me some pictures to print in *73* and *Radio Fun*.

You want to find some interesting speakers for your club meetings. Maybe you can get a chap like our editor Bill Brown, who's sending ATV cameras up in balloons, to explain this weird hobby . . . and how much fun it is. You must have several packeteers who can put on a show and tell. You may even have some working on higher speed packet.

Once you've worn out your built-in talent, you'll want to look for some nearby ham manufacturers or dealers to invite. Ask them to explain why they are in the ham business, which has got to be one of the most frustrating industries in the world. Just get them talking about some of the hams they've had to deal with and you'll be in stitches. Hams, with probably only two exceptions . . . you and me . . . are crazy as bedbugs.

You know, they just don't have bedbugs like they used to. I've only run into 'em once in my life . . . it was a nice hotel, too. But hoo, what a night I had! It was the Australia Hotel in Melbourne. I couldn't see the little buggers, but they sure could bite. Considering some of the hotels I've visited on my travels, I'm lucky.

You can get ham industry people in to talk if you just ask 'em. Sure, you should buy them a dinner with two or three club officers, but that isn't much of a tab. If they have to come in from a distance you might cover their traveling expenses.

Heck, if I'm in your area I'll be glad to stop by and tell you all how rotten you are. I get to music and audio in-

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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Daiwa power supplies use the latest hi-tech circuitry and components providing reliable, regulated DC Power. Short circuit protection protects the power supply in the event of accidental shorting. Crowbar protection protects your rig in the unlikely event of power supply failure. All Daiwa Power Supplies are 120V 50/60 Hz, 220V 50/60 Hz also available.

Model	PS120M	PS140II	PS304	RS3080	RS40X
Voltage (VDC)	3-15	13.8	1-15	1-15	1-15
Current (ICS)	12	14	30	33	40
Current (Cont.)	9.2	12	24	30	32
Ripple (Max)	3mV	3mV	3mV	3mV	3mV
Regulation	1%	1%	1%	1%	1%
Cooling Fan	NO	NO	NO	YES	YES
Size (inches)	5×4×9	5×4×9	7×6×9	7×6×9.5	11×5.5×9
Weight (lbs)	11	11	18	21	22

Cross Needle SWR/Power Meters for All Bands

Model	Freq. Range Int. Sensor	Forward Power	Connectors
NS-660A/PA	1.8-150 MHz	30/300 W/3 kW	SO-239
NS-663BM/BN*	140-525 MHz	30/300 W	SO-239/N type
DP-810	1.8-150 MHz	0-1.5 kW	SO-239
DP-820/N	140-525 MHz	0-150 W	SO-239/N type
DP-830	1.8-525 MHz	0-1.5 kW/0-15 W	SO239/N type
CN-101	1.8-150 MHz	15/150 W/1.5 kW	SO-239
CN-103	140-525 MHz	20/200 W	SO-239/N

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Model	Freq. Range Int. Sensor	Forward Power	Connectors
CN-410M*	3.5-150 MHz	15/150 W	SO-239
CN-460M*	140-450 MHz	15/150 W	SO-239
CN-465M*	140-450 MHz	15/75 W	SO-239
CN-520**	1.8-60 MHz	200 W/2 Kw	SO-239

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	CS-201 2 Position	CS-201G II 2 Position	CS-401 4 Position	CS-401G 4 Position
Frequency	500 MHz	1.3 GHz	800 MHz	800 MHz
Connectors:	SO-239	N type	SO-239	N type
Isolation	+ 60 dB	+ 60 dB	- 50 dB	+ 50 dB
Power Rating	2.5 kW PEP 1 kW CW	2.5 kW PEP 1 kW CW	2.5 kW PEP 1 kW CW	2.5 kW PEP 1 kW CW

Insertion Loss: All models less than 0.2 dB

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dustry meetings in Los Angeles, New Orleans, Chicago, Las Vegas, Nashville, Sedalia, San Francisco, Fresno, Cannes and a few other places, so we might be able to coordinate. Save the doughnuts and coffee until after the main speaker so half the club won't be dozing off on stomachs busy converting all those empty calories into fat to hang even further over already-grotesque beer bellies.

I'll be reading your club newsletters to see if any of my advice gets heeded or if you continue to crank out the same old pap every month. I want to start reading about how much fun the last meeting was and what exciting things you have coming up at the next meeting. I want to see the club business handled and reported in the newsletter so it won't make meetings boring. I want to start seeing pictures of your new licensees, your active club members, stories about how your CB search team has found a bunch of young new CBers and gotten them into your club license classes. I want to read about your TVI/interference committee and their successes. I want to read about hidden transmitter hunts. I want to see some SSTV pictures from rare DX. I want to read about any interesting adventures your members have. Have any gone on a DXpedition? Why not? The Atlanta club mounted a great DXpedition to Navassa a few years back. We've got a bunch of fairly rare spots in the Caribbean that are easy to get to and need activation, so what's holding you?

I want to read in your newsletter about your club's team work on cleaning up our bands. Stop griping and do something about it. If you want me to help, send me information on your worst local offenders and some tapes of the messes they're making. Let's expose these cockroaches to the light.

I suppose it's too much to hope for your club to run a member for the League director for your division? You've been re-electing the same old fogies (and crooks, in one case I could mention from bitter and expensive personal experience) every two years. Maybe it's time to make a change? Even the Russians are beginning to change, so why not you?

Is there a local school your club can adopt? Almost any school will be delighted to have your club work with them to interest their kids in amateur radio. They'll love to have your members come in and talk with the kids. I'll bet you can dig up an old rig to help them start their own radio club. Maybe not. I asked for some help in getting some gear for the nearby Crotched Mountain Foundation Rehabilitation Center Radio Club and got nary one response. The Center is a place where handicapped children are helped to cope with their problems. If you won't help handicapped children with an old rig you aren't using any more, we're talking hard-core ambivalence. So let's see you let loose a little and get some gear into your local schools. I want to read about it in your club newsletters.

Sanger Green with Amelia Earhart in 1931.

Better highlight it for me, so I won't miss it.

How many old HTs do you have kicking around? All they need are some new batteries and a pair of crystals for the local repeater and some kid could be in touch with the world from his wheelchair. The kids are eating up the license classes, but they need equipment. The Center is high up on a mountain, so their HTs will work out fine.

The Fogies

It's been a while since I put some ham legends to rest. For instance, there's this legend about how the hams of yore were great builders and technical experts. What a bunch of baloney. Being a certified fogy myself, I was there and I can report what I found.

I grew up as a ham in Brooklyn (NY). I kept a map of Brooklyn with every active ham marked on it. I listened to every ham band and kept tabs. Then I'd put on my roller skates and go visit them. I don't think there was an active ham in the area I didn't visit.

Since there were virtually no commercially-made ham transmitters in those days (the late '30s), everyone had to build their own rig. This was simplified by articles in *Radio*, the main builder's magazine . . . and to a much lesser extent, *QST*. I built almost everything of mine from *Radio*.

But building a rig from an article and understanding what's going on are two different things. In all my travels I found just one ham who'd built his own receiver. And I found one ham who knew how radios worked. Cy. He was kept busy by everyone else, getting their rigs to work for them. Cy's main piece of test equipment was a neon lamp.

Oh, I read the technical articles. I read *QST* and the two handbooks (the best by far was by Jones W6AJF), but I still only had a hazy idea of how radio really worked. I was fortunate, in a way, that WWII came along in late 1941. The downside was that amateur radio got shut down instantly. The bright side was that I chose to go into the Navy (in 1942) and went through their electronics school. It was superb. Not even four years of electronics in college would have given me 10% of what I learned in nine months at the Bliss Electrical School in Tacoma Park (MD) and the Radio Materiel School on Treasure Island.

When I went aboard the Drum (SS-228) in 1943 I knew every aspect of the radar, sonar, and radio equipment and could fix anything.

Being thrown off the air by WWII had one additional benefit. My favorite radio supply house, Lafayette Radio, ran a special on classical music records . . . a close-out when Royale Records went out of business. I loaded up with one of every title. This got me even more solidly into classical music appreciation and hi-fi, standing me in good stead as a speaker manufacturer in the '50s and as the editor of a music magazine now.

Well, I've been over all that many times, so I won't elaborate. My point is that the hams of 60 years ago were not much different from those of today. They didn't know much more about the rigs they were using. They had only an inkling as to what was in their receivers. They did as foolish antenna experiments as we see today.

Once I got into ham publishing I found that 99% of the hams are ragchewers. It's the other 1% who are the technicians and the pioneers. It's this little group of fanatics that has done the inventing and paid the tab for the rest of us. As a ham publisher and editor for 40 years, I've had the privilege of knowing most of these movers.

So don't let old-timers sell you any bill of goods about the "real" hams of yore. They were no more real than those we have today. Also, if you find yourself getting upset over the idiots on 14.313, just do a little homework in the *QST*s of the late '20s and early '30s and read "The Old Man" (Hiram Percy maxim W1AW) and his endless tirades about rotten QRM. Nothing has changed. The hobby is just as lousy . . . and fantastic . . . as it's always been.

Amelia? Again?

Will someone please tell people to stop trying to find Amelia Earhart's plane? A few weeks ago they replayed the "Unsolved Mysteries" TV program about her and now I read there's a hunt on to find her plane. Sigh. Yes, I know the Navy hates to admit Amelia was on a mission for the Navy when she was lost. And the Japanese hate even more to admit that they executed her as a spy.

If you'll read Fred Goerner's book, *The Search for Amelia Earhart* (Dell #7689, 1967), you'll get the true story. It took Fred several years of hard work to find out what I serendipitously knew. I've read several books about her disappearance, but none, except Fred's, came even close to what actually happened.

So how come ol' Doc Green knows so much about this? Waaal, first of all my father was a pioneer in the airline business. He started out as an Army pilot in 1921, went on to barnstorm, designed and built the Philadelphia airport, and then became passenger manager for Luddington Airlines—one of the first commercial carriers, which was owned by Tommy Luddington and Amelia Earhart. In fact, the airline even used her personal Lockheed Vega when they needed it. She kept her plane at my dad's airport, so I knew it well. This was also why I happened to be in the right place at the right time to be a passenger on the first commercial airline flight in America. I remember getting up in grade school assembly and telling the whole school about it.

Amelia and my dad were good friends and occasionally flew together around 1930. I have pictures of them together.

My father left Luddington to start a new airline between New York and Boston. It would use flying boats so it could operate directly from downtown New York to downtown Boston, thus avoiding the trip to the airports. The main investors were other airlines, which wanted to handle Boston-bound travelers.

In early 1937 Bob Wemple, a long-time friend of dad's, told us about the work he was doing on Amelia's plane. He explained that she was going on a mission for the Navy. Her goal would be to overfly the highly secret Japanese naval base at Truk and take aerial pictures so the Navy could see what was going on. The whole reason for her flight around the world was to get this badly-needed intelligence.

Bob had installed a much more powerful engine and extra wing tanks so Amelia, with Fred Noonan as her navigator, would be able to make the flight from Lae, New Guinea, over Truk, and on to Howland Island in the same time as she normally would have made it direct to Howland. The higher speed would also enable her to outrun any Japanese fighters they might send up. The problem was she missed Howland.

Now cut from 1937 to 1944. I'm at a submarine rest camp in the Marshall Islands for a few days while the Drum was being refitted by the submarine tender Bushnell. In between endless games of Monopoly, some legendary poker games, loafing on some of the most beautiful beaches in the world, and skin diving in the fantastic lagoon, we managed to talk with some natives who had a fascinating story, about a plane crashing seven years previously, the woman (uninjured) and man (injured) who survived. . .the Japanese taking them and their plane to Saipan. Hmmm, so that's what happened to Amelia!

A few months later, when we stopped off at Saipan on our way to Guam for another refit, the natives confirmed that Amelia and Fred had been there. Fred had died and Amelia was executed. When the Americans arrived they exhumed the bodies and burned their plane.

Since I'd heard all about this, it never crossed my mind that there was any big mystery about what had happened to Amelia and Fred. When Goerner's book was published in 1967, I wrote to congratulate him on uncovering the story. I was surprised that he had so much trouble finding out what happened, but with both our Navy and the Japanese doing their best to cover up everything, his story was more about his adventures in fighting the cover-up than what happened to Amelia and Fred.

I remember Bob Wemple well. He visited us on and off for about ten years. He was a short sandy-haired chap with a serious limp and the damnedest waxed mustache I'd ever seen. He was a crack mechanic. He married Miss Philadelphia while flying over that city around 1930.

When the "Unsolved Mysteries" segment about Amelia was aired last year I wrote and explained what really happened. Their report came close, but they had her crashing on Saipan in the Mariannas, instead of the Marshall Islands. They interviewed a native woman who watched the Japanese bury Amelia.

I got a thank-you from "Unsolved Mysteries," but then they repeated the segment again this year with no additions. If I'd been the producer I'd have updated it. Of course, then it might not qualify as "Unsolved." Maybe I should wait for a new series on "Solved Mysteries." Oh well, at least it gives me (or you) something to talk about on the air. . .if anyone ever asks for more than a signal report. No one has yet. But heck, I've only been hamming for 53 years so far. I must learn to be more patient.

"Our gear is going to get more compact, more complex, and cheaper. And that has implications far beyond amateur radio, so we're going to see increased pressures to use our bands for business and personal communications."

Selling IBM Short?

Golly, if you'd only known that IBM's stock was going to plummet, you could have made a killing! How could anyone guess? Well, one way is by reading my editorials.

The cover story on a recent *Fortune* was on the bad news with this bluest of blue-chips, Big Blue. Funny thing about the long article (10 pages). . . no one, including the author and IBM management, apparently understands the fundamental reasons why IBM is sinking. The article, like those I've seen in the *WSJ* and other financial publications, dwells entirely on the symptoms. . .the immediate problems IBM's basic weakness has caused.

Why did I predict about seven years ago that IBM, DEC, Data General, Prime, and Wang were doomed? It doesn't take an astrophysicist to see where technology is headed. And once you understand that you can see why the handwriting is on the wall for the big computer companies.

The minicomputer was the first step. The mainframe computer companies sneered when DEC, Data General, Wang, and others started selling minicomputers. Toys. Well, they were selling computer power at about 10% of a mainframe's cost. Honeywell, G.E., and others ignored the minis and are history. IBM, with around 80% of the mainframe market, got hurt, but learned from the experience and eventually started making minis too.

Their big problem with minis was that they had to sell 10 times as many to make the same money. And they let a few competitors like DEC get too big before they figured out what was happening.

Then along came the microcomputer, selling the same (and higher) power at 10% the cost of the minicomputers. Toys! I had lunch with An Wang and tried to get him to understand what was going to happen. His blindness to micros was unchangeable, even though it was this same blindness by the big iron makers which he had exploited.

I tried to convince De Castro, the president of Data General. He got mad. I talked with the president and top management of Centronics, the largest maker of printers in the world. No soap. They're making pancake turners in the Centronics factory now.

IBM held back getting into micros until the government suit against them for their near monopolization of the mainframe computer business was settled. Then they jumped in. Alas, even if they'd been able to control 80% of the micro market (they've got about 14%), they were still doomed as a company.

When micros appeared it was obvious that super-micros would be along. Now we're looking at micros with the power of mainframes, but at 1/100th the cost. Let's say that IBM gets into the super-micro business. With 80% of the market already in hand, how can they sell a hundred times as many super-micros to maintain their same revenues? Oh, a few more big companies will buy them, but not a hundred times as many.

Worse, technology is inevitably heading toward even faster and less expensive computers which will cost a tenth what the super-micros will cost. Just as the Radio Shack Model 100 laptop, which was introduced eight years ago, had more computing power than the largest computers in the world a few years earlier, we're looking at Cray Computer speeds and throughput for a few thousand dollars, not tens of millions.

And even worse, as the cost of computing and memory come down, smaller, faster-reacting firms can run circles around government-sized behemoths. With all due respect, while there may be some fairly bright people in top management (I say there may be. . .I haven't any personal experience to confirm this), the quality of people at lower levels is often heartbreaking. Thus, entrepreneurs can run the big companies ragged with more innovative products and lower prices.

The microcomputer industry grew quickly, feeding on the complacency of the minicomputer firms. Indeed, it grew at a fairly steady rate of 235% per year for its first eight years. Not bad, eh? When all that started I recommended getting into the business.

By 1981 Radio Shack had 40% of the micro market, Apple had 40%, and around 300 other smaller firms shared 20%. Then IBM came in, with an old buddy of mine, Chaz Cone W4GKF, calling many of the shots. They did well for a while, but eventually faster-moving entrepreneurs took more and more market share away from them.

IBM is firing thousands of people, but you seldom can save a business by economizing. More often you have to sell your way out of trouble. . .and there isn't enough of a market in the whole world to support IBM at its present size once their big iron has been made obsolete.

Hmph, I hear you grumble, so what's all this horn-tooting by Doc Green got to do with amateur radio? Plenty. It may have escaped you that today's transceivers are packed with computer chips. Synthesizers, memories, packet, RTTY, and so on are all made possible by these chips. The faster and more complex they get, the lower the cost of advanced communications technology. What I'm saying, translated into ham language, is that you ain't seen nothin' yet! Our gear is going to get more compact, more complex, and cheaper. And that has implications far beyond amateur radio, so we're going to see increased pressures to use our bands for business and personal communications.

Oh, I get pathetic letters from old-timers who are in sticker shock over the cost of today's radio gear. Apparently they haven't noticed what 40 years of inflation has done to prices. Today's radio gear is an incredible bargain compared to the prehistoric stuff we used to buy for 10 times the price (and more) a few years ago.

As ICs get more and more crammed into them, we're going to be able to do things not even imagined today . . .and in just a few years. Super-micros and megabyte memory chips are going to change things. Packet, RTTY, high speed CW, SSB, and so on, all in an HT, complete with a small keyboard? Yup. It's coming. The question is, now that you know, are you going to take advantage of this and ride the crest of the wave or are you going to flounder around. . .or, like IBM, get crushed as the wave sweeps over? 73

Number 29 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E., K0OV
P.O. Box 2508
Fullerton CA 92633

Photo B. "So it's this way, right?" Igor Krivosheev UW0CZ learns how to use a SuperDF before the FRG-91 foxhunt. Igor teaches radio and orienteering to pre-teens in Khabarovsk.

Foxhunters Invade Oregon

"As you are reading this, 10 Soviets are taking over Portland's Forest Park!" Everyone laughed as Kevin Hunt WA7VTD read these words from the podium at the opening ceremonies of the 1991 Friendship Radio Games (FRG-91).

The sentence came from a news release he had sent to local radio and TV stations to ensure that the Games would not be overlooked by the media. It was a tough sell, because on that day 99.9 percent of Portland sports fans cared only about seeing their beloved Trailblazers beat the Los Angeles Lakers in the NBA playoff series.

But roundball players aren't the only trailblazers in Portland. The hams of that area are pioneers at fostering international goodwill through their hobby. Two years ago, several of them went to Khabarovsk, USSR, for the first Sister Cities Radiosport Games (see the June 1991 "Homing In").

This year is Portland's turn to put on the Olympics of ham radio, and they pulled it off with style. FRG-91 included the first sanctioned international radio direction finding (RDF) competition on U.S. soil.

World-class T-hunters from Southern California, New Mexico, and Washington were invited. They faced a team of championship foxhunters from Japan, and two teams from the Soviet Union. WA6OPS and I were there to serve on the judging team and to cover the games for *73 Amateur Radio Today*

Radiosporting Goods

There are many obstacles to face in putting on an international "foxhunt," as these RDF competitions are called. One tricky chore is selecting and providing RDF gear. To ensure fairness, all competitors should use the same type of equipment. All sets should give uniform performance.

On-foot competitive RDF methods for 2 meters vary greatly from country to country. At home, the Soviets use simple tuned-radio-frequency (TRF) receivers and 3-element yagis. Even if they could have brought these simple receivers with them, the sets lack enough selectivity to perform properly in the crowded band conditions of a typical U.S. city.

In Japan, commercial foxhunt receiver/antenna units are popular. These gadgets feature a synthesized receiver built into the boom of a 2-element phased array (see Photo A). Electronic attenuation and audible strength indication are included. The Japanese 2 meter band is only 144–146 MHz, so their fox-trackers won't work on the popular USA foxhunt frequencies above 146 MHz without modification.

One tricky chore is selecting and providing RDF gear. To ensure fairness, all competitors should use the same type of equipment.

There is no "standard" RDF set for North American foxhunters. The L-Per by L-Tronics is popular with search/rescue folks who hunt aircraft ELTs, but its 4-channel, crystal-controlled receiver limits its usefulness on 2 meters. Dual-antenna time-difference-of-arrival (TDOA) sets are often seen because they work with stock hand-held FM transceivers. (See "Homing In" for September and November 1989.) However, they lack any indication of signal strength to help gauge distance to the fox.

After much discussion, the FARS foxhunt committee decided that all competitors would use SuperDFs. These dual-antenna TDOA sets are manufactured by BMG Engineering of Temple City, California. Owner Russ Andrews K6BMG provided 16 antenna sets and DF display units (Photo B) in kit form to FARS a few weeks before the date of the competition. One of the "big three" ham manufacturers provided pocket-sized hand-helds for use with the SuperDFs.

Building 16 RDF sets in a short time—what a task! But Portland's hams were up to it. When I arrived the night before the FRG-91 foxhunt "dry run," a houseful of them were tweaking up the SuperDFs and bolting on the cases, in between glances at the Blazers on TV.

On the morning of 29 May, all hands gathered in giant Forest Park to test the fox transmitters and RDF sets. It was the competitors' first and only chance to learn how to use the gear before the official competition the following day. It rained, of course.

Despite the bad weather, everyone was excited and eager to seek out the five fraction-watt transmitters that had been scattered on the 200-acre course by Dick Fredrickson WA0DIM and Mike Holgate N7OKJ

The rain didn't hurt the transmitters, RDF sets or receivers. But Murphy had a more serious problem in store.

Killer Cross-Mod

All the fox transmitters' MCW signals were loud and clear through the SuperDF dual antennas with the DF sets powered down. But the fox tones immediately disappeared into the noise when the SuperDF control units were turned on, starting the electronic switching of the dual whips.

Some loss of sensitivity due to commutation of antennas is normal in a TDOA RDF set. But this time it was worse than anyone had ever seen before. The miniature hand-helds were useless.

Full-sized hand-helds with wideband front ends worked better. Older sets with narrow RF stages were best. My old Tempo S1 worked fine!

There are three tall towers near Forest Park with VHF communications, broadcasting, and paging antennas. The presence of strong RF fields causes cross-modulation products to be generated when antennas are switched at an audio rate, as is done in a TDOA RDF set

Continued on page 93

Photo A. Champion foxhunter Yoshiko Yamagami JQ1LCW shows a popular Japanese RDF device to Kevin Kelly N6QAB, winner of the FRG-91 individual foxhunt gold medal.

Photo C. Gene Shulgin UZ3AU, Technical Editor of Radio Magazine *in the USSR, pitched in during the late-night tune-up/repair session.*

Number 30 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Colin's Visit

My six-year-old nephew, Colin, came to visit a few weeks ago. He and his mom came up to "the country" from "the big city," for a little fresh air.

We took him to the town fair, which just happened to fall on that weekend. We pointed out all kinds of neat things he doesn't get to see in the city: the deer on the side of the road at dusk, the ground hogs that have a perpetual fascination with our back yard, and the lightning bugs that fill up the yard on a summer evening and mimic the starry sky that glows down from above.

On Sunday morning, Colin reminded me that I had promised to show him my radios. His mom had told me that he was very excited to hear and talk to people from other countries. He and I trotted off to my shack, powered up and sat down behind the HF rig. The concentration on this little guy's face was amazing. He knew that he was entering Uncle David's special room, and he was making sure he was on his best behavior so that I would invite him back.

As we scanned the bands, looking for foreign sounding voices, it soon became apparent that we were experiencing one of those solar flare band wipe-outs that are common in the summer. 10 meters... dead. 15...ditto. I tuned up and down 20 meters, figuring that the DX chasers wouldn't let me down. They did. 40 meters at least offered some signals coming through, but the farthest we could hear was Pennsylvania—not exactly the geographic tour my nephew was hoping for.

So...there I was...sitting next to a six-year-old with the chance to instill in him a love of radio and the darned ionosphere was ruining everything. I could see Colin's interest beginning to wane. Then he asked me "What's that?" and pointed to the code key, which in my shack is usually pushed to the back of the desk and covered with a pretty good accumulation of dust. I explained to him about Morse code, turned the antenna switch to the dummy load and started sending. I sent C-O-L-I-N and told him that was his name in code. Colin's face lit up!

I wrote the dots and dashes under the letters on a piece of paper and explained how to say "dah-dit" instead of "dot-dash." When I asked him if he would like to try it he almost ripped the key out of the rig. His six-year-old fingers took a few minutes to get the hang of it, but after two or three tries he was sending fairly copyable code.

Colin's mom was called immediately to the shack, to witness Colin's newfound skill. He sent his name. Then he sent "hi mom." Mom was suitably impressed. We spent the rest of the morning figuring out short words and simple sentences. The rhythm of "CQ" was a little difficult, but he seemed fascinated by it and eventually mastered it.

After a while, we tried an actual contact. I called a quick "CQ" in the Novice portion of 40 meters and was answered by a weak signal in Virginia. Colin stared at my hand as the sound coming out of the speaker was instantly transferred to letters on the yellow pad. Every time he heard one of the letters he recognized, he shouted it out—"I! S! C! H!" He had a lot of questions about some of the funny looking "words" like QTH, RST, ES, OM, etc. I missed some stuff being sent because I wanted to explain as he asked the question. So what! It was your standard "name, QTH, RST" QSO, and everything was sent twice, so I didn't miss all that much. The signal faded and I caught a final "73" before it disappeared altogether. Colin and I sat at my operating desk and went over the text. He liked the idea of having so many "code" words like QSL and RST.

I let him send some more into the dummy load and taught him a few more letters.

> ***"I sent C-O-L-I-N and told him that was his name in code. Colin's face lit up!"***

When it was time to go, he grabbed the piece of paper that had the dots and dashes on it and took it with him.

Colin did me a great favor. He reminded me that Morse code—with the prejudice and pressure removed—can still be an exciting way to turn on a young mind to amateur radio. I had forgotten that. Anyone who is afraid that the code will eventually pass away only has to look at the face of a six-year-old as he learns how to say his name in this "foreign" language.

A six-year-old's attention span can often be measured in minutes, or at best, hours. Sometimes a task or subject will be so interesting that it is maintained over several days. until it is replaced by something else equally new and fascinating. Without reenforcement every few days, I figured Colin would find something else to occupy his inquisitive mind and active imagination. Sure, when he got home he showed his dad how to send a few words in Morse code (or, as he calls it, Morris code), but I knew he'd soon be off to other interests.

Colin's visit was several weeks ago. Today I received a birthday card from him, his mom, and dad. On the left-hand side of the card, in the steadiest hand a six-year-old can muster, was written,

"·—·· ——— ···— ·
—·—· ——— ·—·· ·· —·"

Thank you, Colin.

·· ·—·· ——— ···— ·
—·—— ——— ··—
— ——— ———

Number 31 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

Some of our readers have expressed an appreciation for this column, and N2FZ has told me how helpful it is to him... in fact, he clips it out each month and posts it in the shack for reference. I'd like to hear from you readers who enjoy the column, and especially those of you who have comments, pro and con, about what you like and don't like, and how you think it can be improved. Also, I'd like for you to rate it for accuracy—a batting average, if you will. We all like to know how we're doing once in a while.

One last item before we go to this month's forecast: Please gat a copy of the March 1990 *Smithsonian* magazine and refer to the article, "Do Solar Fireworks Bring Stormy Weather?" on page 32. Author Stephen P. Moran gives us a look at the sun and its behavior, and I find the article one of the best I have read on the sun and its influence on radio communications and other aspects of our environment. The photographs and charts alone are worth looking at, while the text is fascinating

Similar But Not the Same

Conditions for September, October, and November will be similar to conditions last March, April, and May. Spring and fall equinoxes exhibit the same number of hours of daylight and darkness, and as the days progress past the equinox, HF communications deteriorate slightly on the higher frequency bands and improve slightly on the lower frequency bands.

For September, you may look for POOR conditions between the 1st and 3rd, and again between the 20th and 22nd, and finally between the 27th and 29th. "Poor" means that DX paths through the auroral zones are difficult due to active minor (or even major) storm levels in earth's magnetic field. "Fair" means some paths are open while others may be closed, and "Good" means that worldwide DX is probable on those days of the month so marked in the chart.

It is always desirable to check WWV broadcasts at 18 minutes past any hour for their "Solar and Terrestrial Indices" numbers. You want high solar flux (above 180), low Boulder A index (below 10), and low Boulder K index (2 or below) for best propagation conditions via the ionosphere to either short- or long-skip locations.

In September, static levels will decline as Northern Hemisphere thunderstorms subside, and DX on the 40, 80, and 160 meter bands will improve dramatically as the winter months approach. However, the shorter daylight hours mean that the HF bands at 20 meters and above will close earlier, at dark or slightly thereafter, with the 10 and 12 meter bands dropping out first, followed by the 15, 17, and 20 meter bands. Good hunting!

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	[illegible]	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	[illegible]
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20	20	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20	—	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	20	20	20	—	20	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20	20	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	—	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	—	—	20	[illegible]	[illegible]	—	—
U.S.S.R.	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

Notes: [illegible]

SEPTEMBER 1991

SUN	MON	TUE	WED	THU	FRI	SAT
1 P	2 P	3 P–F	4 F	5 F–G	6 G	7 G
8 G–F	9 F–G	10 G	11 G	12 G–F	13 F	14 F
15 F	16 F	17 F	18 F	19 F–P	20 P	21 P
22 P	23 P–F	24 F–P	25 F–P	26 F–P	27 P	28 P
29 P	30 P–F					

Continued from page 91

These cross-mod products are mostly out-of-band, so they are rejected by narrow receiver front ends. But the latest generation of tiny hand-helds leave no room for selective input circuitry. Furthermore, today's HTs are deliberately designed, as a feature, to be wideband. (Don't you like being able to eavesdrop from 130 to 174 MHz with yours?)

FARS organizers spent the remainder of Wednesday rounding up older narrowband hand-helds for the competitors, and checking them out. A few of the SuperDFs didn't work properly even on narrowband receivers, so John White K7RUN hosted a troubleshooting party at his home that night.

Mike McCarter KA7NOO, Gene Shulgin UZ3AU (see Photo C), and others helped me check over each SuperDF control unit and antenna set, and repair them as necessary. Soldering irons were flying as we hurried to correct reversed diodes, loose BNC connectors, and wrong-value capacitors. By 2 a.m., all units were repaired and tested, and it was time to get some sleep.

Big Day for USA

Except for some old batteries on the borrowed hand-helds, the RDF gear worked fine during the May 30 foxhunt. The five-transmitter course was about two miles in total length. Contestants were allowed a maximum of three hours to find the foxes, in order. Except for a five-minute rainshower, the weather was fine.

Experience with switched antenna RDF methods paid off for the USA. Every US entrant was able to find all five transmitters. Kevin Kelly N6QAB took the gold back to Albuquerque as fastest individual foxhunter. He completed the course in one hour and fourteen minutes.

The winning hunting team was "US-Red," made up of Mike McCarter KA7NOO, Lewis Osborn KC7MZ, and Ron Miller WB6JGV. All are members of the Northwest ELT Team of Vancouver, Washington. KA7NOO was second place individual hunter, and KC7MZ was third.

Second place team was "US-Blue," consisting of N6QAB and Southern California hunter J. Scott Bovitz N6MI. The Japanese team of Yoshiko Yamagami JQ1LCW, Zen-ichi Oba JN1JPX, and Tuk Tsukui JR1WYB took the bronze.

No hams on earth are more friendly or more interested in international goodwill than those in the Portland area. Despite the "Beat LA" signs in every store window (for the basketball tourney, not the foxhunt), they made everyone feel welcome and part of an important amateur radio event, with lots of promise for the future. You'll be reading more about FARS and international radiosporting in this column and elsewhere in *73 Amateur Radio Today*.

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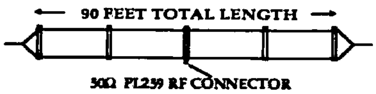

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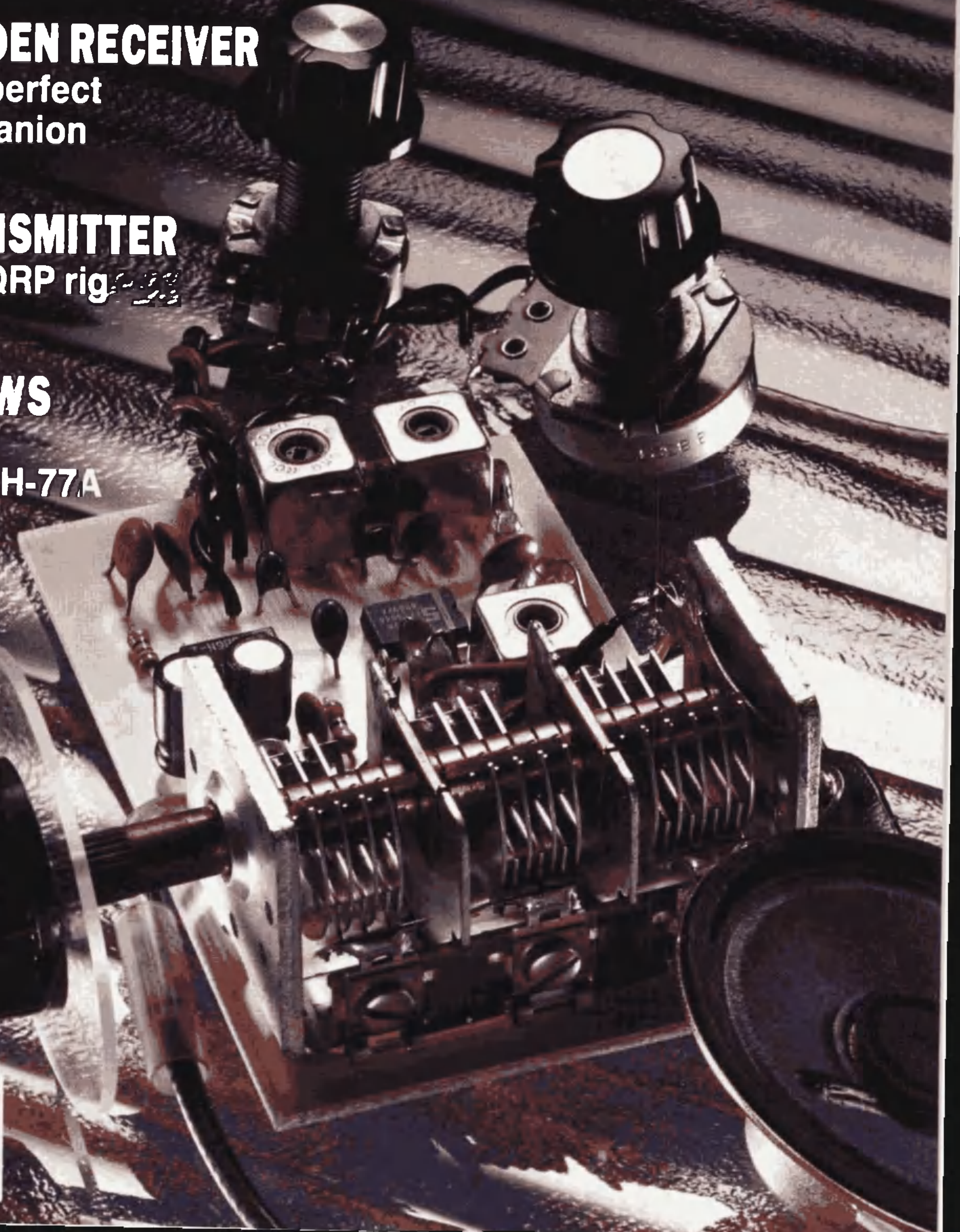

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LETTERS

From the Hamshack

Bobby DeVito, Tampa FL I'm writing to let you know how much I enjoy your column in *73 Magazine.* I've been interested in amateur radio for almost 15 years now (I am 26), and just passed my codeless Tech exam last month. I am extremely thankful that I am now going to be a ham, and I will try harder to learn the code so I can be a General.

Even though I am a "no-coder," I still feel that I have as much or more to contribute to amateur radio as anyone. I've been involved in electronics since I was a child (my father helped develop the first GTE-Sylvania Technical Schools) and have been through the Navy BE&E and Electronic Warfare schools. I am a professional musician, working on my second album (sorry, but it's rock, not ragtime), and also do some studio engineering. And I've always loved ham radio! Now at least when I go on the road, I can take my HT with me and possibly make some friends, if they will condescend to speak with a "no-coder."

OK, now that I'm finished blowing my own horn, I can get to the heart of the matter. I really enjoy your column and I think that you are a positive force for the entire amateur community. You're a really good writer, and I enjoy your style. And your sense of humor.

You'll hear from me again. For now I'm stuck in VHF and UHF land, but I will make it to HF one day. If your ears can stand instrumental rock guitar music, I'll send you a copy of my last album, *Guitar Salad.* Hopefully, I'll be able to elmer some of my musician friends. Keep up the good work, and NEVER SAY DIE!

Sid Lynch KC4ZVJ, Jacksonville FL I would like to home-brew a 2 meter FM transceiver base station. Ideally, the rig will have repeater offset, digital frequency readout, and tone encode capability.

I'm having a great deal of difficulty locating construction articles or plans for such a rig. It seems that most construction articles focus on HF-QRP-CW rigs. Is there a reason for this, given the growth of the no-code Tech class that cannot legally operate such rigs?

Is it possible to home-brew a rig like the one I'm talking about without an electronics degree and a lab? I would appreciate any advice you may have that could lead me to information on such rigs.

I figure that if it is possible to get a decent VHF home-brew set on the air, this would open all sorts of other projects. For example, I would love to home-brew a packet station or perhaps get into satellite via home-brew.

Sid—You might want to check out Ramsey's 2m FM transceiver kit. They've been selling so well we haven't been able to get one for review yet.

As for a 2m FM total home-brew construction project . . . how about it, readers? If anybody's put together such a project, we'd love to take a look at it. . . . David N1GPH

Pete Stark K2OAW, Mt. Kisco NY I vote for "Poor Man's Packet" by WB2EMS and N8KEI as possibly the best ham radio article and project of the last 10 years, if not more.

I haven't built it yet, but I have a hunch the PMP project may have a feature the authors haven't mentioned: by eliminating the TNC with its CPU, etc., the PMP may also eliminate much of the QRM which normally makes it really tough to use an HT without a remote antenna.

Joel E. Dumont KA1LNJ, South Deerfield MA I have been a licensed amateur radio operator since 1984. This past spring, I upgraded to Technician, thanks to the encouragement of the Mount Tom Amateur Repeater Association's class, taught by K1MEA. I am now halfway to General class, having passed the written portion of the test.

I do not object to the possibility of paying a fee for an amateur radio license. In fact, I agree with the idea of paying $5 a year for the 10-year license. I sent cards to that effect to the representatives and senators listed in your July editorial.

I applaud your efforts to focus ham radio on fun, talking, and tinkering. After all, this is supposed to be a hobby, right? I think it is still possible for innovation to come from hobbyists, since most big companies tend to stifle creativity in the name of conformity and order. It may take a lot of money to develop and market things, but ideas come to those who have the time and interest.

W.E. Bennett N7IVM, Bellevue WA This time you've really done it. There are probably hams all over the U.S.A. who are foaming at the mouth! License fees!

Seriously, I have always felt that the decision to eliminate fees was a potential weapon to be used against amateur radio. My only reservation is whether it is possible to get the fees where they should be, into that section of the FCC which is concerned with our affairs. I don't want a free ride, but I would like my "fare" to help keep my "bus" on the road!

George C. Fennell N3EQE, Butler PA On the ham front in Butler County, things are really cookin'! I am pleased to announce that my latest Novice/Technician class yielded nine new ham operators to our ranks, six of them being "codeless Techs," and more are coming aboard due to the long overdue codeless license.

Also, ATV is alive, well, and being heavily promoted in the area. We are in possession of an ATV repeater and all the "goodies" to go with it, and have received permission from the local VA Hospital to place it in operation upon their rooftop tower. This location is prime, and will enable everyone in Butler and the county-wide area easy access to the machine. Right now there are seven individuals in the process of purchasing ATV gear, and many more contemplating the move.

Keep it up . . . you're our inspiration and guiding light!

Mark A. Stevens AB4YE This past lunch hour, I spent time reading over the last three years of gloom and doom from your editorials. Gasp! . . . I agree with you. We have no hope of keeping our frequencies with arguments to the FCC that we are a vital national resource, that the bands we have now are crowded, that we are on the cutting edge of technology, etc.

If we are going to be able to keep our frequencies . . . I think that we need to get down to basics. Business is going to do everything it can to lobby us out of our airspace. Problem is, there really is no room left for continuous growth of radio technology as it's now envisioned. As soon as they take our frequencies away from us, they will find that they still don't have all the room they need, and they will have to develop other ways of transmitting data for profit. (As archaic as they look now, phone lines hold more promise for data transmission than do radio waves.) One of our first priorities must be to convince the FCC of this fact: Ham radio's frequency space is only a small crack in the wall of physics that limits the amount of usable radio frequency space available for profit making. Once our ham bands are gone, they're gone for good . . . and for nothing.

We need to look at our ham bands as a valuable, disappearing national resource, just as we look at our national forests. As hams, we have to stop telling ourselves how valuable we are, how important our mission is, and start telling the government how valuable public frequency space is to the nation. We need to make it known to anyone who will listen that we love our radios the way some people love their campers or motorcycles or coins or guns. We need to make our case for our right to keep what we enjoy.

We need to cease being a bunch of emergency chasing, council meeting, jurisdiction disputing political idiots who do nothing but set up ego gratifying repeater councils and radio societies, then spend any remaining time trying to find someone to take to court. We need to become a unified group of hobby-loving individuals who will effectively let the world know how much we appreciate the little reserves of public frequency space we now have. . . .

We are not on a mission from God. We need our national parks, and we need our international frequencies . . . not because we are an asset to the nation, but because the frequencies are an asset to the public, an asset too valuable to leave entirely to business interests.

I, as a ham, am not an indispensable asset vital to the correct functioning of our military and emergency services . . . ham radio is an asset to me personally. I know that the world could get along without me, but I surely don't know what I (we hams) would do without ham radio.

Jeff Kinsman NH6VH From time to time we all get a bit disillusioned with amateur radio. Then something comes along to refresh our sense of wonder and faith in hams and the hobby. Something like that happened to me last spring when we were in the Persian Gulf with "Desert Storm." I'm the chief operator of the MARS station onboard the aircraft carrier *USS Nimitz.* In addition to running phone patches via MARS, we've formed a group of amateurs to promote ham radio onboard. Anyway, as luck would have it, we "smoked checked" the finals in our amplifier when we got underway. Sure enough, when we arrived in the Gulf, we couldn't contact any MARS stations back in the states using a barefoot rig. With over 6,000 men on *Nimitz,* the need for contact with home is vital. We thought we were sunk—literally! To my surprise, amateurs all over the U.S. responded to our call for help. They stayed up late running patches (many times at their own expense), relayed message traffic, and generally kept our spirits high during a difficult deployment.

Their extra effort proved to me that although we have our differences in the hobby, when the chips are down, we pull together and bring out the best we have to offer. Isn't *that* the foundation of amateur radio—service to fellow citizens? The next time you're depressed after reading gloom and doom letters, ask a sailor from the *USS Nimitz* what he thinks of ham radio—your wonder and faith will be renewed!

Daniel M. Jordan AA9AN, Evansville IN I am writing this letter about contests on the amateur bands. I have been an amateur radio operator for 15 years now. I am 28 years old, and have a family. Since my job and my family take up a lot of time, I usually try to get on the radio on the weekends when I can. But it seems to me every weekend there's another contest.

Now, don't get me wrong; I have nothing against contests. I'm sure they're an exciting aspect of the hobby. But why should a few people's enjoyment ruin it for everybody else? I'm not saying do away with contests, but limit them to a certain portion of each amateur band. Just look at the contest section of each amateur publication and it's packed. Every little club has its own contest weekend. Before long, there won't be standard ham radio contacts, just one long 365-days-a-year contest. I ask that any ham who is tired of being interfered with to please drop the FCC a note and voice your opinion. Maybe together we can all use our radios again.

Daniel—Please don't bug the FCC. This is not a situation where they could or would do anything—except get even more disgusted with ham operators who come crying to them every time they don't like something. Why don't you try writing a clear and constructive letter to the organizations who sponsor the contests? They are the ones who can change the contest rules. Your idea has merit. Just make sure you direct your energy in a positive way—and toward the proper authority. . . . David N1GPH

Darrell Davis KC4KGN, Fort Meade FL I enjoy reading your editorials every month. I have been licensed for a little over two years now and have enjoyed every bit of it. I got into amateur radio because of computers and computer communications, and experimenting, which I enjoy. I do mostly digital on HF and very little phone except checking into the ARES Net on HF. I am an assistant E.C. for ARES here in Polk County. Only phone I do is on 2 meter FM repeater or simplex. Trying to get started in satellite. I am 22 years old, so you do not have to be an old-timer to enjoy this hobby.

I am afraid that your predictions will come true unless some changes are made. The old men on our bands need to get out of their "live and die by CW" attitude and realize that Part 3 of the Amateurs Code exists: "The Amateur is Progressive." I like your end-chewing of your readers to get them to think for themselves.

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Issue #373

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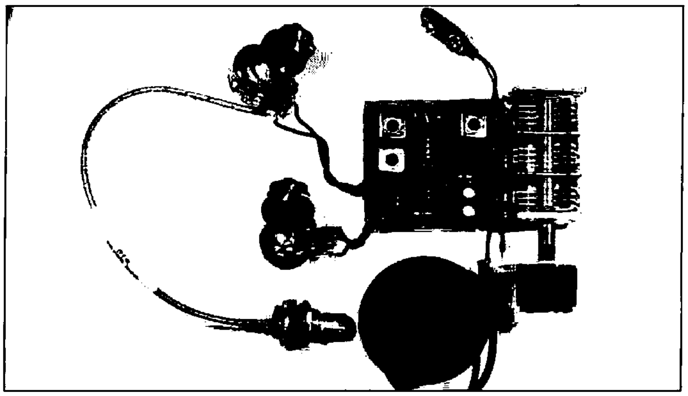

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Cover design by Alice Scofield. Cover photo by Larry Dunn.

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NEVER SAY DIE

Wayne Green W2NSD/1

Wayne's Ego

Now and then I get a nastygram bitching about my inflated ego. I'm not sure why readers are concerned about me not having a low sense of self-esteem. Sure, I enjoy getting appreciative letters and I hate getting nasty ones. I particularly love getting letters from readers who tell me I've had a positive effect on their lives.

Yes, I do tend to aim my writing toward my more intelligent readers, but not out of arrogance or imperiousness . . . I just don't feel comfortable talking (writing) down to people. It isn't in my mind to say, hey, look how incredibly smart I am . . . look how much I know. I write to help people understand things. No one can be an expert on everything, including me. But I do feel a need to share the things that I've learned or enjoy with others.

I keep urging you to try new ham activities. But I haven't asked you to do anything I haven't done. I've done moonbounce, made many OSCAR contacts, worked seven states on 10 GHz, won Sweepstakes, VHF and DX contests, DXpeditioned from dozens of countries, worked around 350 countries, and so on. I helped pioneer NBFM, SSB, RTTY, SSTV, etc. I've built all kinds of gear . . . and I've had so much fun doing all this that I've probably been a nag trying to get you to share my fun.

Yes, of course I have an ego. You mean you haven't? And I like you to know some of my wins. But I also share my bad times with you . . . like my loss of *Byte*, one of the worst traumas of my life. And my bout with the IRS, which probably ties with the *Byte* epic.

Like most of you, I do dumb things. Like letting myself be talked into running for VP a few years ago. It seemed like a good way to get some exposure for my ideas on improving education, solving the welfare mess, and helping the homeless. I let my enthusiasm carry me away into lala land. I should have known that the media has virtually zero interest in constructive, creative ideas. They're after bad news, so they concentrated on my old IRS debacle. Bad news sells papers, and journalists aren't about to forget it.

I was reminded of that when an ex-governor of New Hampshire called recently and asked if I would consider running for VP again. I gather there is a lot of anxiety about Quayle and many politicians are looking for viable alternatives. Not me, thanks. I'm an idea person, not a politician.

As I said at the time I ran, my concept of the vice-president was that he should be responsible for running national affairs, while the president would handle the international stuff. That's almost what we actually got. Bush *has* been handling foreign affairs. It's just that, as far as I can see, no one's been running the country.

A corporate VP has responsibilities other than twiddling his thumbs, waiting for *the* call. A VP is usually responsible for running a major aspect of the business. Well, why should running the country be different?

I think we all agree that the country would do better with some management. Our educational system is a disaster. The drug problem hasn't improved, despite task forces and endless propaganda. Crime is still getting worse. I'm not aware of any changes in the welfare mess, in improving the unemployment situation, or helping ease the homeless problem. Look at the S&L, the BCCI and other banking messes, our decaying infrastructure, the HUD disaster, the continuing defense contracting and environmental messes! Quayle, what in hell have you been doing? Playing golf and making "good will" trips?

Medical costs are going up faster than inflation. College costs are zooming. Organized crime is stronger than ever. Heck, I'm up against 'em in *two* of the industries I'm in. With no national leadership, there's no reason to expect things to improve.

Yes, I probably could help with many of those problems, but I don't need the aggravation. No amount of money could get me involved with the bureaucractic quagmires involved. Not even my vaunted ego could do it. I'm very busy and happy doing what I'm doing.

Both Bush and Reagan have handled the situation well. They've kept their hands off running the country and blamed Congress for everything. Maybe you missed the 7/22 *Time* editorial (p.70) on exactly that subject. Too bad; you shouldn't.

To help amateur radio grow faster, I've started *Radio Fun*. I believe this will help lots of hams get more fun from our hobby. I hope it will make learning theory more fun. I hope it will make trying new modes and bands more fun too.

But I'm also in the middle of starting a new company to put out sampler CDs to help the record companies get their new releases selling faster. Major New Releases (MNR) is gearing up to put out two or more samplers a month. We'll be sending these CDs to some 10,000 record stores, bundled with our *Music Retailing* publication . . . and giving another 15,000 or so absolutely, totally, completely, 100% FREE to my *CD Review* readers.

My Adventures In Music (AIM) samplers (also FREE) project, each with tracks from 16 or so different independent record company releases, has been a huge success . . . and needs to be expanded.

Another new project is our *IMPS Journal*, which will go monthly to over 5,000 independent music producers. Then there's our *Guide to FREE Music*, starting in November. And more CD releases from my Greener Pastures Records. Yep, I'm busy. My only major problem is a desperate need for more people to help do all these things.

I'd love to organize ham tours to Europe, Africa and Asia. The hams there would love to meet us and host us. But travel costs money, and most hams seem to be terribly short of that. Where have all of you been while the banks were handing out billions? Were you holed up in your hamshack dit-dahing while the money trees were being stripped?

I remember one creative ham who went around the world, visiting rare countries and charging top dollar to DXers for contacts. He told me he was pulling down around a quarter of a million a year. I don't think he was exaggerating.

I organized a ham European tour back in 1963. It was a corker, with 73 of us on the trip. We had hamfests in London, Paris, Geneva, Rome, and Berlin. None of the hams on that trip will ever forget it! I see several of them every year at Dayton and they still remind me how much fun they had.

I tried to do another in 1965, but by then ARRL's "incentive licensing" proposal had gutted the hobby, and it was all over. I did conduct electronic and computer tours to Asia in the '80s, but we seldom had more than a dozen hams along . . . compared to 250 on the tours.

Now I'm planning some music industry tours, which should be fun. But wouldn't you enjoy going to Africa with me and getting on the air from 3D6 or 7P8? Wouldn't you like to visit ZS and talk with the local hams and get their perspective on what's going on down there? They'd love to have you come, I promise you.

Alas, before I can round up ham tour groups and lead them fearlessly to exciting new adventures, hams are going to have to have more disposable income. Any red-blooded ham would love to get on the air from a rare country and brave the pileups. Talk about ego! Suddenly you're a star and the whole world is groveling at your feet for the kiss of your QSL. Oh, if you only had the money, what a fantastic time you could have!

But making money means changing. Most people have never made any more money than they needed. Heck, they've never made quite as much as they feel they need. But making money means working harder, and we're all basically lazy, so we make do and begrudge those who do work harder the fun they can afford.

A few people either luck into it or are smart enough to figure out how to make more money without having to work so hard. It doesn't take a computer scientist to notice that entrepreneurs seem to have a much better batting average on getting rich than people working for the government, for large corporations or teaching. Hmmm, with the same amount of effort, you stand a chance of hitting the jackpot. Golly!

So I've been irritating the hell out of *73* readers for the last 30 years pointing this out. My ego does expand momentarily when I hear from a reader who's taken my advice and found it worked. But most hams . . . and for some reason this seems to be particularly centered on ARRL stalwarts . . . put me down as crazy and keep on staying poor. I've never met either a smart or a rich ARRL supporter . . . and I've sure met a lot of hams.

I used to spread my gospel via my computer magazines, too . . . and now I'm at it in my music magazines. Is all this ego driven? It doesn't seem like it to me, but then how many of us recognize our faults? I love it when I hear from someone I've helped . . . and I brag a little at the time. But I don't forget that gratitude is one of the least felt of human emotions, so I expect I'll have as many friends at my funeral as I did to support me when the IRS did a job on me. And, at 69, that funeral is getting closer. Makes it more difficult to make long-range plans . . . which hurts, because there's so much that needs to be done and so few people interested in helping.

Amateur radio is the greatest and most valuable hobby in the world. It should be spread to every third world country so they'll be able to cope with

Continued on page 80

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Calling All Hams

In March 1992, a space shuttle launch is planned with the first mission in a series of 10 flights called ATLAS-1 (Atmospheric Laboratory for Applications and Science). One of the payloads, SEPAC (Space Experiments with Particle Accelerators), will investigate the ionosphere and magnetosphere. SEPAC will use an 8 kW electron beam modulated as a VLF transmitter by audio tones between 50 Hz and 7 kHz. Attempts will be made to receive and record this signal on earth at various locations.

Since there are a limited number of ground stations, high school classes and the amateur experimental community are encouraged to participate in listening to and recording transmissions. The footprint of the VLF signals will be difficult to define without a large number of ground receiving stations. A low cost ($35 to $40) kit receiver has already been designed and tested by amateurs. The complete kit, with full documentation and project details, is available this fall.

The student effort has been dubbed INSPIRE (INteractive Space Physics). This will be the first time in history that such an extensive data taking capability has been available to space physics researchers. Some 10,000 high schools will be invited to participate. Participants will also benefit from the experience of assembling a simple but effective broadband VLF receiver, getting hand-on experience in obtaining scientific data, and coordinating a field station.

During the actual mission, amateur radio will play a vital role in relaying schedule changes for SEPAC transmissions. Amateur radio is already being used for daily premission communications regarding high school involvement. Most importantly, local ham clubs and individual amateurs can help students with kit building and setting up field listening operations. Individual amateurs are also invited to participate as ground stations during the mission.

For more information on the high school connection with project INSPIRE, send an SASE (two stamps) to Bill Pine, Science Department, Chaffey High School, 1245 N. Euclid Avenue, Ontario CA 91762. Interested hams and clubs should contact (also include a two-stamp SASE) Jim Ericson KG6EK, 226 Charles St., Sunnyvale CA 94086-6063. *TNX Jim Ericson KG6EK.*

New UHF DX Record

Two new microwave world records were set on Sunday, July 29, when Paul Leib KH6HME, at the 8200-foot level of the Mona Loa volcano, made contact with Chip Angle N6CA in Southern California on 3456 MHz at 2325 UTC. The short CW contact brought a signal report of RST 319 over the 2,471-mile long path. An hour later, at about 2425 UTC, Leib and Angle made a similar CW contact on 5760 MHz, setting a new world record for that band. Each of the stations was running 5 watts output to a 4-foot dish antenna, using equipment specifically designed for the path by N6CA. Both contacts were monitored, recorded, and verified by other amateurs living in the Southern California area. *TNX Gordon West WB6NOA and Bill Pasternak WA6ITF for their report in the* WESTLINK Report.

Photo A. Chip Angle N6CA in his record-breaking portable microwave station. Photo by Gordon West WB6NOA.

U.K. Novice License

Now that the first Novice licenses have been awarded in the U.K., the media is showing interest. On the BBC's "newsround," Natasha Weir 2E1AAE was seen contacting G3OUF/P, and Vicky Foster 2E1AAD was covered on BBC "Radio 5." Interviews are lined up for the TV program "Why Don't You . . ." and other TV and radio features are planned. These will be reported in full in a future issue of *Radio Communication.* Amateurs will now be hearing Novice licensees coming over the air, and all the help and patience given to these youngsters—and the not-so-young newly licensed—by experienced hams, will ensure mutual enjoyment of the hobby. Novice callsign prefixes are: England, 2E; Scotland, 2M; Wales, 2W; Isle of Man, 2D; Jersey, 2G; Guernsey, 2U, and Northern Ireland, 2I. In all cases, these prefixes are followed by either a Ø for Class A or a 1 for Class B licenses. TNX *WESTLINK Report, Number 607,* and GB2RS.

Reciprocity with Mexico

According to Rudy Baca of the FCC, the final reciprocal amateur operating arrangement with Mexico would be similiar to the agreement the U.S. has with Canada. "The goal is complete reciprocity with Mexico . . . the operating parameters are still being worked out. We expect to have a fairly detailed press release shortly. It is a matter of clearing everything with Mexico."

Over a year ago, near Mexico City, at a U.S./Mexico Consultative Group on Communications conference, Ralph Haller N4RH of the Private Radio Bureau suggested that reciprocity would be an appropriate topic. After a year of study and exchange of information, a second U.S./Mexico conference was held last July in Chestertown, Maryland. The FCC will issue a public notice describing all procedures in the reciprocal agreement when they are final. TNX *W5YI Report, Vol. 13, Issue #16.*

Soviet Goodwill Trip

David Larsen KK4WW, John Douglas NØISL, and Bob Fribertshauser W6YMR, members of the Foundation for Amateur International Radio Service (FAIRS), visited the *Radio Sport Federation* staff in Moscow last spring. The FAIRS members, also known as the "59 Group" were on a three-week goodwill mission delivering equipment to Soviet amateurs for emergency digital radio communication. Nine computers, nine TNCs, two HF transceivers, four HTs, and three VHF transceivers were donated by various companies. FAIRS Soviet amateurs involved in the project were Victor Goncharsky UB5WE, Yuri Katuytin UA4LM, Helen Goncharsky RB5WA, Victor Golutvin UB5WPR, and Vladimir Kiebanovsky UB5WCV. TNX *FAIRS.*

AREMIR

This month—October 2–12—an Austrian cosmonaut will operate AREMIR (Austrian Amateur Radio Experiment) aboard Mir. It will be part of a 16-experiment package called AUSTROMIR '91. AREMIR equipment will include a modified Alinco DJ-120E transceiver for 2 meters (power limited to 3 watts), a TNC and CW generator for the AREMIR beacon, and a laptop computer for packet. The exact frequency hadn't been determined at the time of this news release, but look for it around 145.8–146.0 MHz. Continuous packet bulletins are to be 36 characters long, with a six-second tone for Doppler measurements.

AREMIR has a strong educational focus, and an Austrian team of hams has created a special receiver for Russian and Austrian schools. TNX *SpaceNews, MCImail, John Magliacane.*

The Sudden Receiver

A simple-to-build receiver for 160–20M.

by Rev. George Dobbs G3RJV

It is sometimes said that the age of the amateur radio builder has gone. In the "great days," there was a huge electronic scrap yard left over from World War II, and hams could buy cheap parts and equipment just waiting to be modified for amateur radio use. They were good days; I remember well a local radio surplus store in my small home town in the north of England which had items that even a schoolboy could afford to buy. The store has now long since gone, and so have those bargain surplus items.

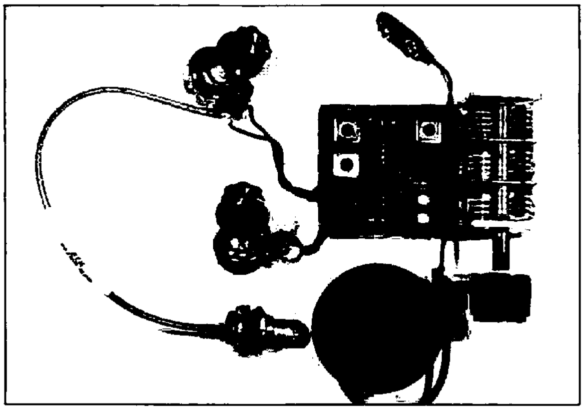


Photo. The Sudden receiver.

But my belief is that times have never been better for the ham who wants to build his own equipment. The world is full of electronics; from life-saving equipment to novelty junk, it is around us all the time. Smaller components, safer voltages and cleaner techniques mean that equipment can be built on a tray on the kitchen table—and cleared away after use. Components have never been cheaper; compare the price of electronic parts 30 years ago and now, and then compare average incomes. It is cheaper, easier and more convenient to build electronic equipment than ever before. I suspect that motivation, rather than means, is why more of it is not done.

There may not be the surplus items we used to find, but there is another kind of surplus these days. It is what I call the "scraps from the rich man's table." Modern technology has produced many specialized components and items for a particular job. If they are for consumer applications, the high sales volume often means that cheap, and sometimes clever, devices can be found. These may not be for applications directly related to amateur radio, but that is the joy of the new surplus market. The fun is taking cheaply produced devices designed for special applications, and making them fit what we want to build. That is real amateur radio in action!

In the UK there have been indications in recent years of a revival in home construction among radio hams. This has been shown by the popularity of the G-QRP Club and its little journal, SPRAT. The club has always leaned heavily towards the use of home-built equipment, and SPRAT has grown into an informal constructor's magazine. Perhaps part of its popularity is due to the number of simple construction projects that have been published in SPRAT. Many amateur radio constructors in the UK have found their first radio project in its pages. I proffer all this cheerful information because I edit SPRAT, and for many years I have tried to include projects suitable for the beginner.

In the past, SPRAT has contained many simple HF bands transmitter circuits which can be built in an evening with a few parts. These give the experience of working on an amateur band with a few watts of home-generated RF. *[Ed. Note: Those in the U.S. can join the G-QRP club and receive SPRAT for $12/year from Luke Dodds W5HKA at 2852 Oak Forest, Grapevine TX 76051. Overseas readers can obtain more information directly from the author.]*

Recently there have been requests to provide a very simple receiver circuit for the amateur bands capable of being built by a first-timer and yet able to yield reasonable results on the amateur bands. The Sudden Receiver was the result of this request.

The Sudden Conception

The name "Sudden" has nothing to do with the speed and ease of building this little radio (even though it is simple and easy to build); rather, it is the name of the town where it was conceived. I live in Rochdale, a

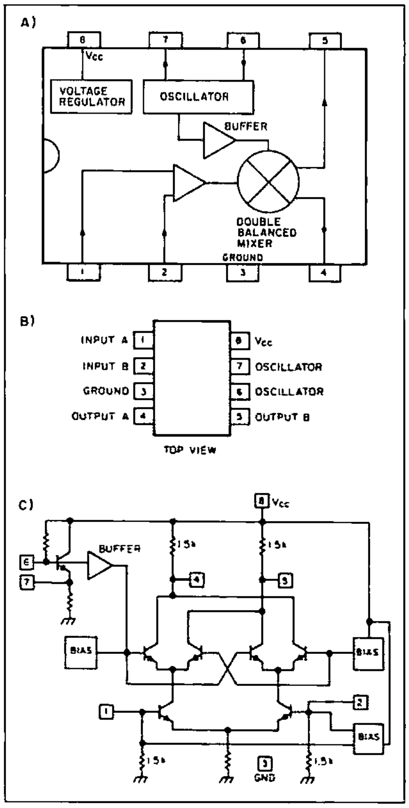


Figure 1. The Signetics NE602.

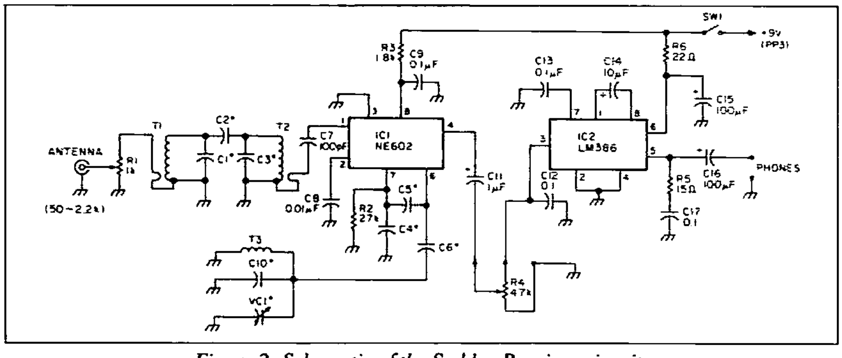


Figure 2. Schematic of the Sudden Receiver circuit.

Table. Component Values for Different Bands

Band	C1	C2	C3	T1	T2	VC1 + C10	C4	C5	C6	T3
160	220 pF	10 pF	220 pF	BKXN-K3333R	BKXN-K3333R	All Sections + 100 pF	0.001 µF	0.001 µF	560 pF	BKXN-K3333R
80	47 pF	3 pF	47 pF	BKXN-K3333R	BKXN-K3333R	All Sections + 100 pF	0.001 µF	0.001 µF	560 pF	BKXN-K3334R
40	100 pF	8.2 pF	100 pF	BKXN-K3334R	BKXN-K3334R	1 Section + 47 pF	560 pF	560 pF	270 pF	BKXN-K4173AO
30	47 pF	3 pF	47 pF	BKXN-K3334R	BKXN-K3334R	1 Section + 68 pF	680 pF	680 pF	220 pF	BKXN-K3335R
20	100 pF	3 pF	100 pF	BKXN-K3335R	BKXN-K3335R	1 Section + 68 pF	220 pF	220 pF	68 pF	BKXN-K3335R

town in the northwest of England, in an area called Sudden. Sudden was once a village in its own right, and has a fine, stone-built Church of England church where I serve. I am the Vicar of Sudden, who just happened to design a simple radio receiver.

The Sudden could be described as a generic NE602 direct conversion receiver. It uses that fine and useful chip, plus the ever-popular LM386 audio chip. Another requirement of the design was to avoid the use of hand-wound coils, a common source of problems for beginners, and incorporate commercial inductors. The final design used a range of TOKO coils, given the UK designation KANK - - - - . *[Ed. Note: In the U.S. the TOKO prefix is BKXN-K.]* These have a range of inductance values useful for shortwave applications.

The NE602 is a fine example of the kind of "rich-man's scraps" we have today. It was originally designed for cellular radio applications, but has found its way into many amateur radio circuits. The internal workings and pinouts are shown in Figure 1. It is indeed a useful device: a balanced mixer, RF oscillator, and voltage regulator all wrapped up in one small, 8-pin DIP package. All the main workings of a direct conversion receiver under one roof!

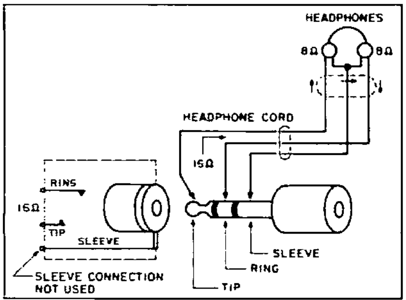


Figure 3. Walkman-type headphones can be used without changing the plug.

Circuit Details

The circuit of the Sudden is shown in Figure 2. It is a simple receiver having only two active devices and three inductors. The input comes via a simple attenuator, the judicious use of which is essential, especially on the 40 meter version in the UK. T1/T2/C1,2,3 form a bandpass filter. The band chart table gives values for the appropriate TOKO coils. The values are calculated to give a flat response across each band. Once the filters have been peaked with the coil cores, there is no further need of adjustment during operation.

C7 couples the signal into one port of the NE602. The mixer is operated single-ended, which is a compromise in favor of simplicity. A similar design, the Neophite (QST, February 1988), used a balanced configuration. In practice I have found that the results with this circuit did not warrant the extra complexity in obtaining a balanced input and output.

The oscillator portion of the NE602 is around pins 6 and 7. Looking at the circuit, if it is turned sideways, experienced constructors will recognize the popular parallel tuned Colpitts oscillator. Tuning is by means of T3 with VC1 and C10. The prototype receivers used a surplus variable capacitor which has three gangs of approximate values: 10 pF + 10 pF + 20 pF. It may be possible to find a similar capacitor (see the Parts List), or you can use a single section variable capacitor. It is essential to use a good quality air-spaced capacitor. The values on the band chart show the values for C10 when using the prototype variable capacitor. With other capacitors, some experimentation will be required. The kit version of the Sudden uses the values and the capacitor from the table.

The single-ended output is coupled via C11 to a volume control, then into the LM386 audio amplifier. The LM386 is configured in as a 200 times gain amplifier with a simple Zoebel filter R5/C17 on the output. The audio output will drive a small speaker, but is designed for headphone reception. A pair of Walkman-type headphones are adequate for the receiver (see Figure 3). It saves family arguments if you are using in-house teenager headphones on the receiver.

Figures 4(a) and (b) show the layout of the receiver. The receiver fits onto a printed circuit board measuring 2" x 2". The board shown here has been extended to mount the three-gang variable capacitor used in the prototype receivers. This portion can be cut away to give a smaller size with the variable capacitor mounted remotely from the board.

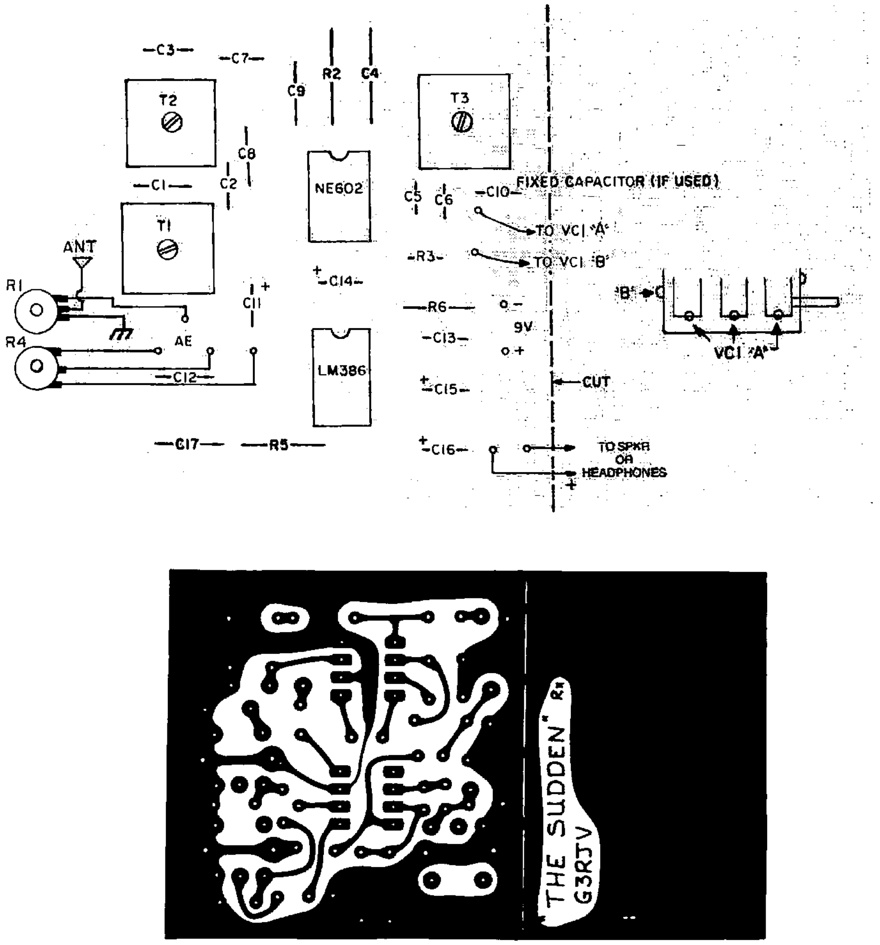


Figure 4. (a) Parts layout for the Sudden Receiver and (b) the foil diagram.

Parts List		
Resistors		
R1	1k	potentiometer
R2	27k	resistor
R3	1.8k	resistor
R4	4.7k	potentiometer
R5	15 ohm	resistor
R6	22 ohm	resistor
All resistors are ¼ Watt		
Capacitors		
C1-C6	See the Table	
C7	100 pF capacitor	
C8	0.01 µF capacitor	
C9,C12,C13,C16,C17	0.1 µF capacitor	
C10	See the Table	
C11	1.0 µF/35V tantalum capacitor	
C14	10 µF/16V tantalum capacitor	
C15	100 µF/25V electrolytic capacitor	
Coils, ICs and Misc.		
T1,T2,T3	See the Table	
IC1	NE602	
IC2	LM386	
SW1	SPST switch	
VC1	Variable tuning capacitor (three sections: 10pF, 10pF and 20pF) see the Table and the note below.	

A kit of all parts including the PC board, the TOKO coils and the tuning capacitor is available in the U.S. for $29.95 + $3 shipping from Kanga US, c/o Bill Kelsey N8ET, 3521 Spring Lake Dr., Findlay OH 45840. Tel. (419) 423-5643, 7-11 p.m. Eastern. Kanga US will supply the blank PC board separately for $6 + $3 shipping. The complete kit is also available overseas from Kanga Products, 3 Limes Road, Folkestone, Kent CT19 4AU, Great Britain.

Variable tuning capacitor VC1 is also available as part # 2311007 from A.R.E. Surplus, 15272 S.R. 12E, Findlay OH 45840. Tel. (419) 422-1558.

The TOKO coils are also available from Penstock at (800) 736-7862.

Finishing Touches

The casing and hardware for the Sudden is a matter of individual taste. The main tuning capacitor does require a vernier drive for best results. The input attenuator potentiometer, R1, must have a linear track and can be in the value range of 50 to 2.2k ohms. Sturdy wiring is required for good mechanical stability between VC1 and the board.

Tuning up the receiver is very simple. A signal generator or other low level signal source is helpful, but it can be tuned up with band signals. The first step is to get the oscillator on to the band. This may be done by connecting a signal generator to C7 and adjusting the core on T3 until the signal is detected. It is also possible to listen for the signal on another receiver. A simple wire from the receiver antenna laid over the NE602 should be enough to pick up the signal. The core, T3, is adjusted to give the best coverage of the band in question using VC1.

The bandpass filter does require a little more work. I have obtained surprisingly good results by simply peaking T1 and T2 on signals in the band. The best method is to feed a signal source into R1 and adjust T1 and T2 several times. Begin in the center of the band and peak T1 and T2 for best output. Then repeat this operation at either end of the band, ending finally by again repeaking in the center.

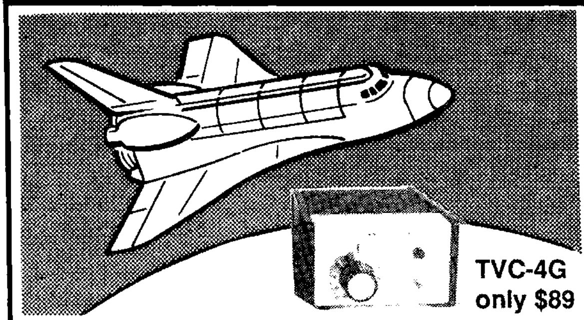
The receiver does have a conventional 50 ohms input impedance. It is advisable with such a simple receiver to attempt to match the antenna to the receiver. A good operating procedure is to turn up the audio gain control, R4, to the point where the internal noise of the LM386 just becomes a nuisance and then use the attenuator, R1, as the main gain control. This is a simple receiver, and hitting it with too much signal will bring out its worst traits.

The Sudden is capable of very surprising results for its simplicity. The morning that I am typing this text, a Sudden builder telephoned me to say he had been listening to VKs on SSB with a dipole and a Sudden on 20 meters. It is simple, it is inexpensive, and it is easy to build, but it certainly hears lots of stations. It makes a very good first receiver project or an ideal receiver for scouts or school groups.

Build the Sudden, and enjoy! 73

You can contact Rev. George Dobbs G3RJV, at St. Aidan's Vicarage, 498 Manchester Rd., Rochdale, Lancs, OL11 3HE, Great Britain.

AMATEUR TELEVISION



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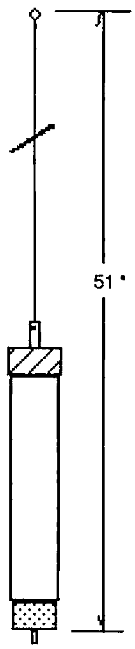

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A 10M Sideband Transmitter

Add voice to your QRP station.

by Bruce Auld NZ5G

Described in this article is a relatively simple, VFO controlled, double-sideband transmitter with 1 watt output for 10 meters. It's capable of easy and comfortable communications. For example, while this transmitter was still breadboarded, with its innards splayed all across my station operating table, I contacted K7EVL in Wenatchie, Washington, on the first call. He checked my signal, and he, my two-year-old Katie, and I had a merry contact.

The sideband transmitter is designed for hams who are interested in construction. It is also aimed at hams who are neither technicians nor engineers, but who possess some knowledge of RF construction technique. Where possible I've used commonly found parts, commonly used values, and the smallest number of different parts possible. Unless you live in a major city, however, you may have to mail-order some of them.

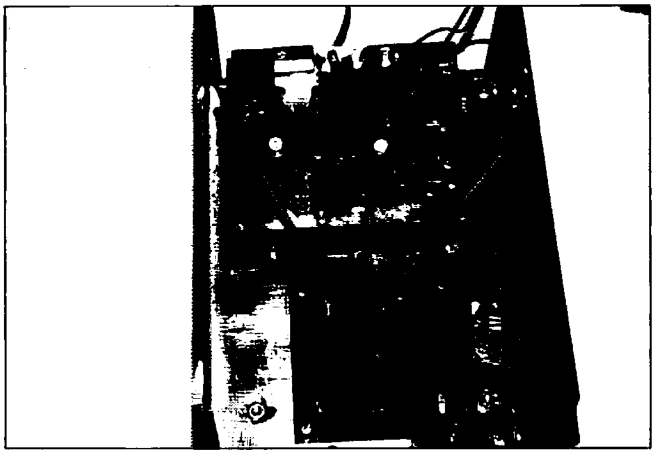


Photo A. A 10 meter transmitter you can build yourself!

This project is my distillation of the excellent work of W7ZOI and WA7MLH, whose projects taught me the vagaries of sideband generation. It employs simple, known circuitry with no surprises. It is not single sideband because of the added expense and circuitry to filter the unneeded sideband. However, with plenty of room to spare on 10 meters, this is no problem. The transmitter employs a manual transmit/receive scheme so that inexpensive microphones without PTT mechanisms can be used, and it is intended to be used with the ham's existing station receiver.

The Circuit

Figure 1, the block diagram, shows the flow of the transmitter. The whole of the circuit is designed in modules and interconnected to form a team. Constructed this way, it's easier to understand and troubleshoot.

Referring to Figures 2, 3, and 4, the transmitter is centered around an 11 MHz IF. This frequency was chosen only because I had a bunch of 11 MHz crystals on hand. Any convenient combination of frequencies for the IF/VFO combination can be used to reach the 28 MHz goal. The transmitter employs the simplest form of sideband generation, a single transformer and two diodes. It is fed with audio from the mike and its amplifier, and mixed with the 17.5 MHz VFO signal. In order to place the VFO frequency as low as possible for stability, a mixing scheme was used (hence another 11 MHz crystal). For this purpose, the magical NE602 was used, which is a wonderful device. This chip is a double-balanced mixer boasting an

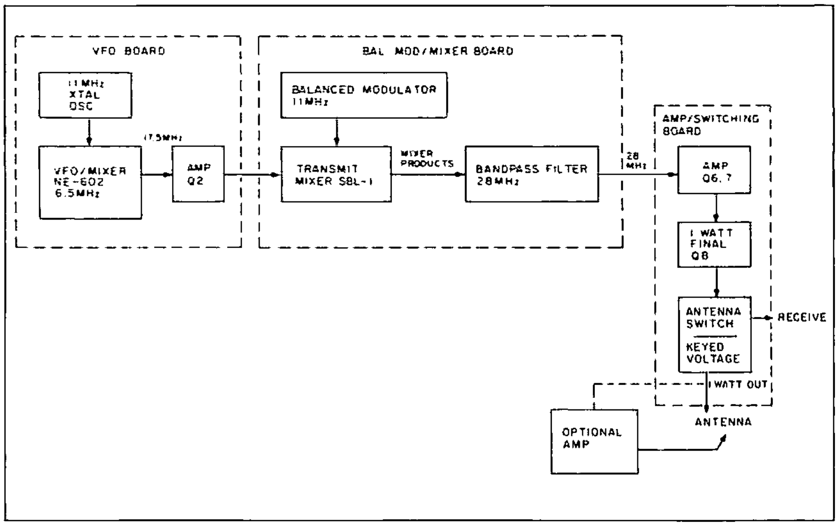


Figure 1. Block diagram of how the 10 meter sideband transmitter works.

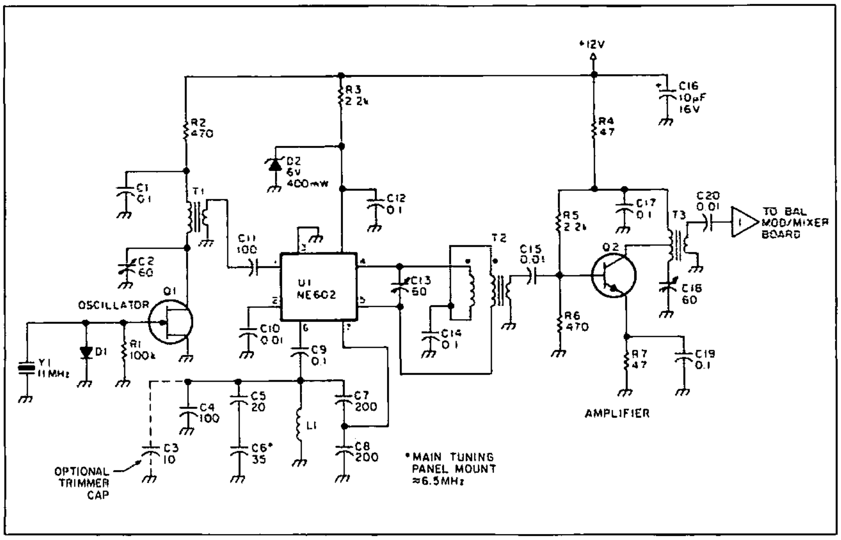


Figure 2. The VFO board.

onboard oscillator. A very respectable signal can be developed with one of these.

The signals from the sideband generator and VFO are amplified and fed into a diode-ring mixer module, U3. The jumble of frequencies that emerge go through a 28 MHz three-pole bandpass filter and a very nice 50 mV 28 MHz signal results. From here it only needs to be amplified. The next two stages are simple class A broadband amplifiers. The final amplifier transistor is the well-known 2N3553. In my unit, however, I use an inexpensive alternative, an RCA 4013 that I purchase from my friendly local parts merchant in single lots for 89 cents each. It performs equally well, and I appreciate the price more each time I destroy one experimenting.

The switching circuitry is designed to change the antenna from receiver to transmitter and to apply voltage to the amplifier chain during transmit periods. The NE602 VFO stage is free running for the sake of stability, but the carrier oscillator in the balanced modulator is normally off. This stage is switched on during transmit periods and for spotting your frequency in the station receiver. This is necessary because you would otherwise hear your carrier (though it has been suppressed) in the receiver all the time. These functions are carried out by a simple DPDT relay and two SPDT toggle switches.

Construction

The transmitter is constructed on three separate circuit boards. Their size was chosen mostly at random, but I have arranged them so that they will fit in a Radio Shack cabinet. The etching pattern and the parts placement guide are provided in Figures 5–7. The parts placement diagrams are viewed from the component side. If you use double-sided PC boards for the balanced modulator or the amplifier, be sure to rout out a space around each hole on the component side. I do this carefully with a ⅛" drill bit. Single-sided material should work just fine for these boards, however.

One may wonder why a single board is not used for this project. Briefly, I have

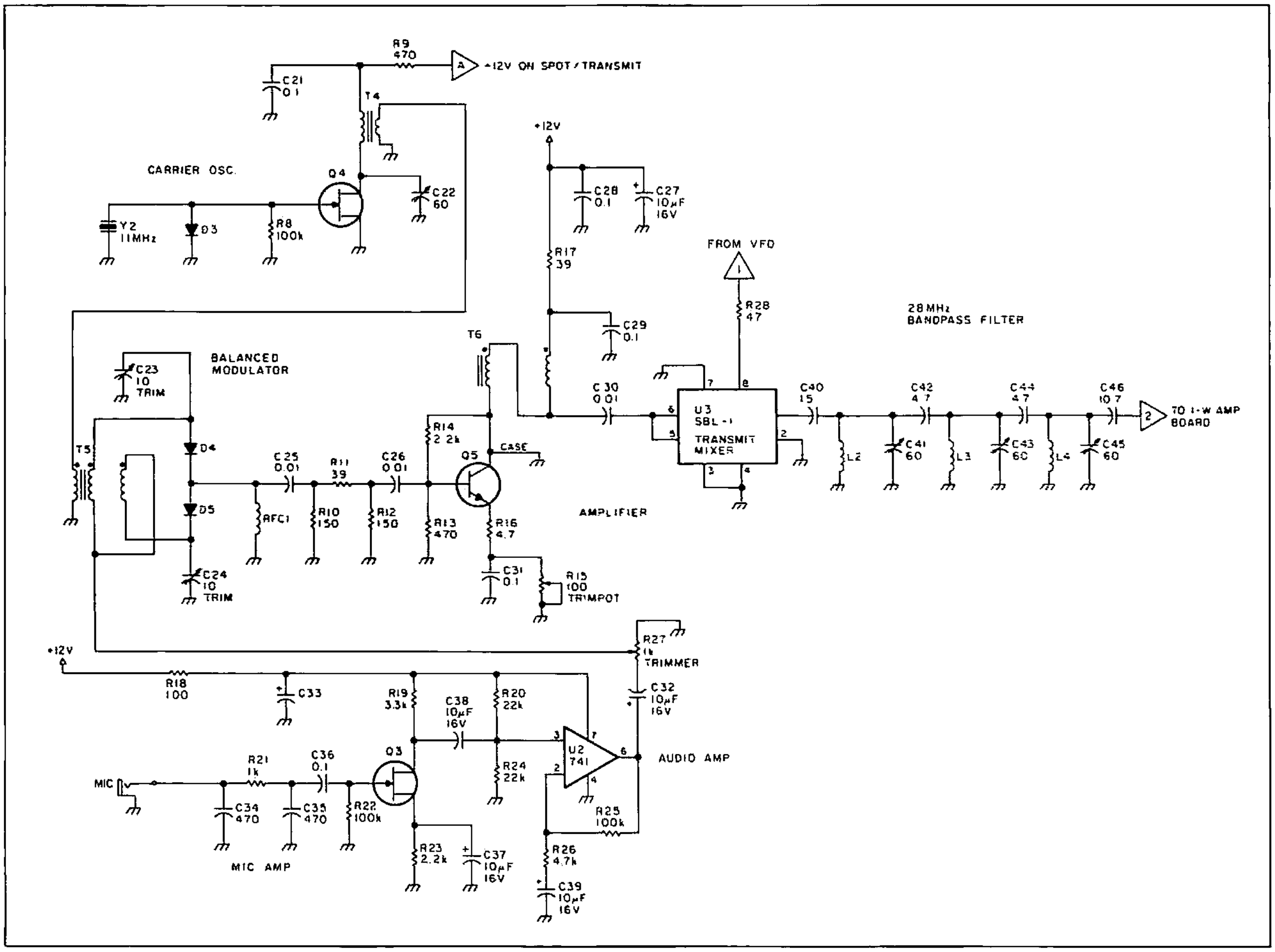


Figure 3. The balanced modulator/mixer board.

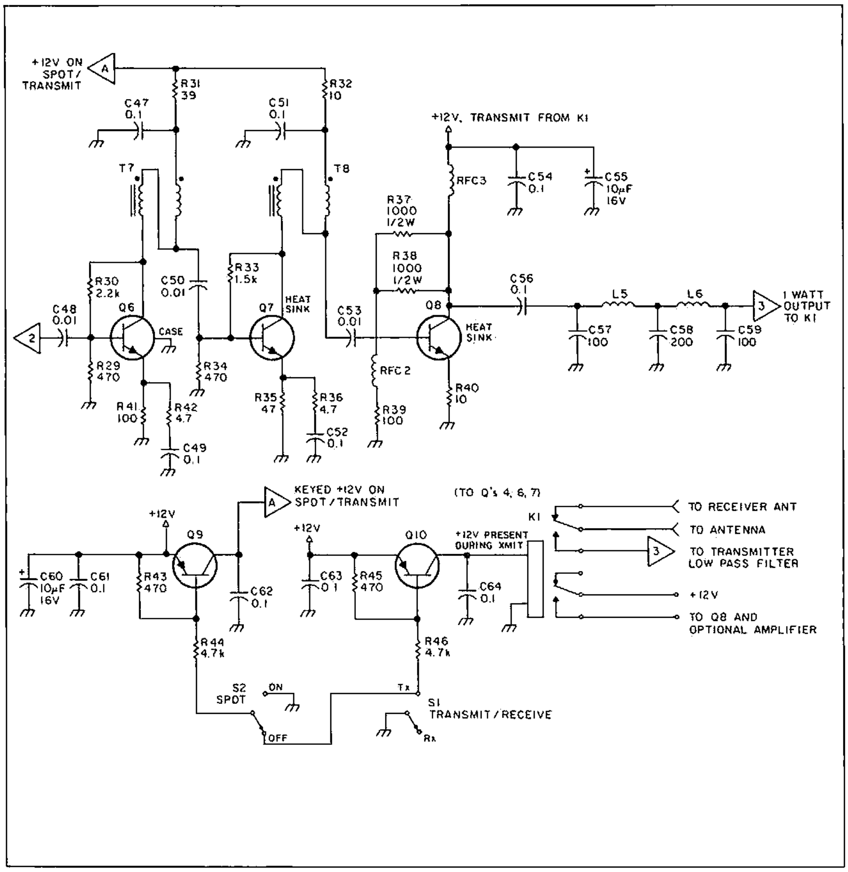


Figure 4. The 1 watt amplifier and switching board.

found that separating these stages greatly increases interstage isolation. Grounding is enhanced and a greater overall stability can be achieved.

I recommend that you build the transmitter in stages and get each stage running properly before you proceed to the next. Some hints for construction of the various modules are as follows:

The VFO

The VFO is the single most important part of the transmitter. If care is not taken to observe basic construction rules, the VFO will drift and you will be very unhappy with the rig. This PC board must be single-sided. Using double-sided board near the frequency determining components of the VFO will introduce unintended capacitance that's unstable with temperature change, causing drift. One frequently overlooked component in this regard is the tuning capacitor. Some home-brewers mounted them on a small square of single-sided board soldered vertically on the VFO board and directly behind the panel-mounted vernier dial. This mount actually forms one wall of the VFO compartment. If you follow this method, make sure the wall is not made of double-sided PC board. Of course, if you use a small aluminum box to house the VFO, this will not be a problem.

L1 lies face down on the board, glued in place after you have determined that the VFO is oscillating in the right place. I have allowed for a small trimmer for adjusting the VFO frequency, but squeezing together or spreading apart the turns of L1 will also work. Make sure that all of the parts coming off of pins 6 and 7 of IC1 are mounted as rigidly as possible.

The Balanced Modulator/Mixer

The balanced modulator/mixer board is the easiest to build and the least critical, except for the bandpass filter. Simply populate the board with parts. The spacing I have used for the pads on the board may not match your junk box parts, but I encourage you to use what you have. Notice, however, that the values for the fixed capacitors in the bandpass filter are rather specific. This stage is the most unforgiving of mistakes, and these values must not be changed casually. If you have no 4.7 pF capacitor, then try a 5 pF. Likewise, a 10 pF might be substituted for the 10.7 pF unit, but beyond that type of substitution, you may significantly affect the performance of the filter.

Note that there is a 6 dB pad (composed of R10, 11, and 12) at the output of the balanced modulator. This helps to achieve a good 50 ohm load for the balanced modulator, and the same input impedance for the following amplifier stage. Originally, I designed the trans-

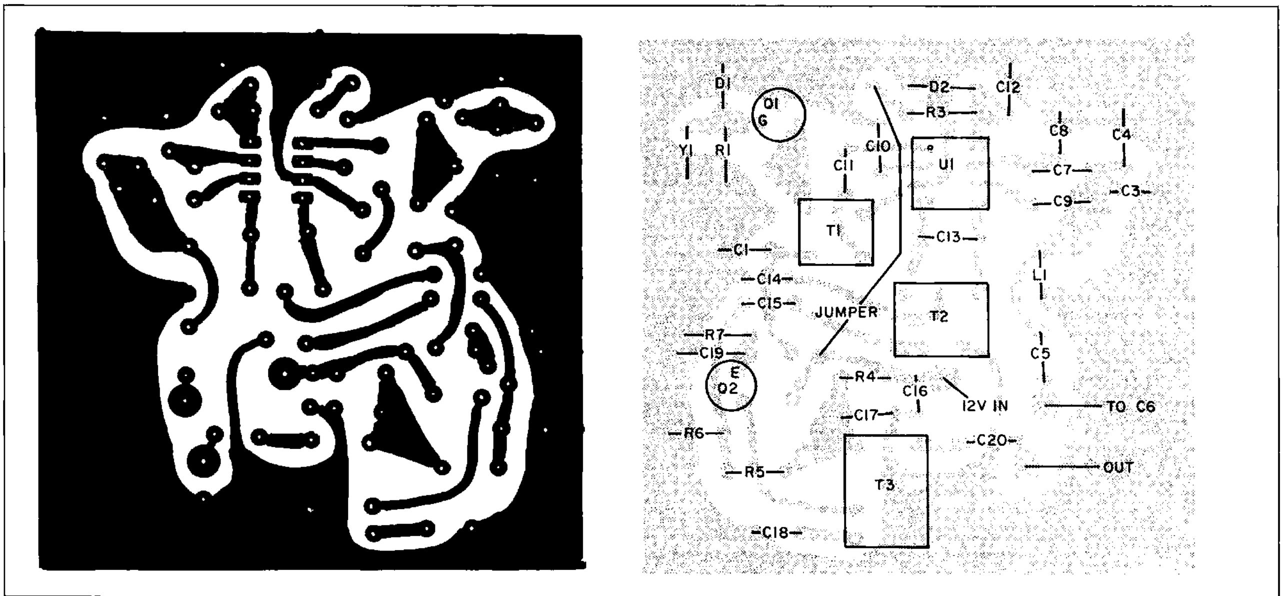


Figure 5 (a) The VFO foil pattern. (b) Parts placment.

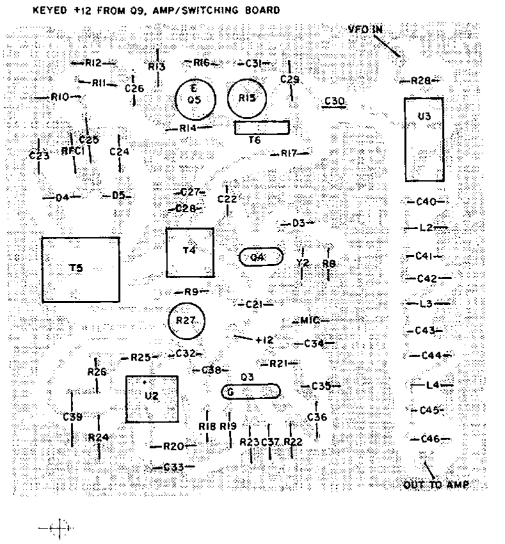
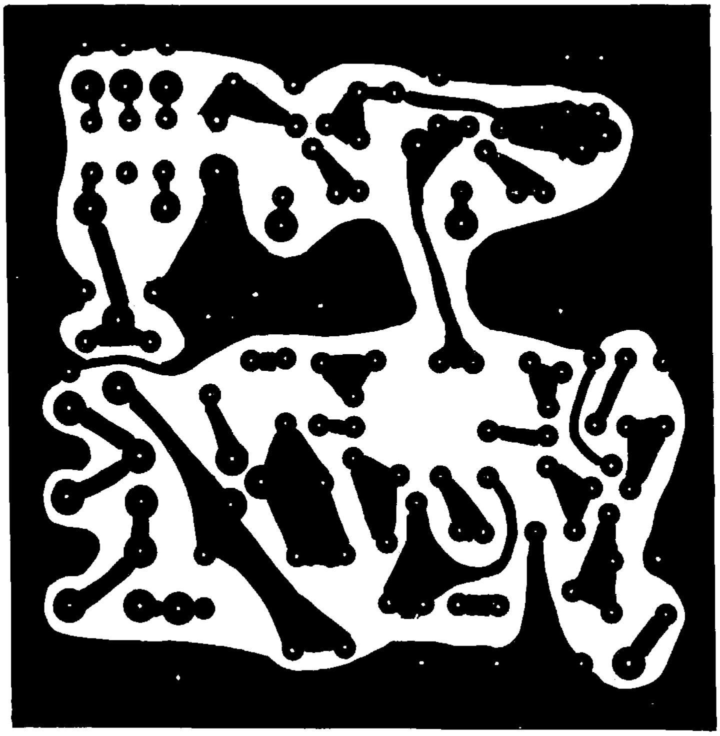


Figure 6 (a) The balanced modulator/mixer foil pattern. (b) Parts placement.



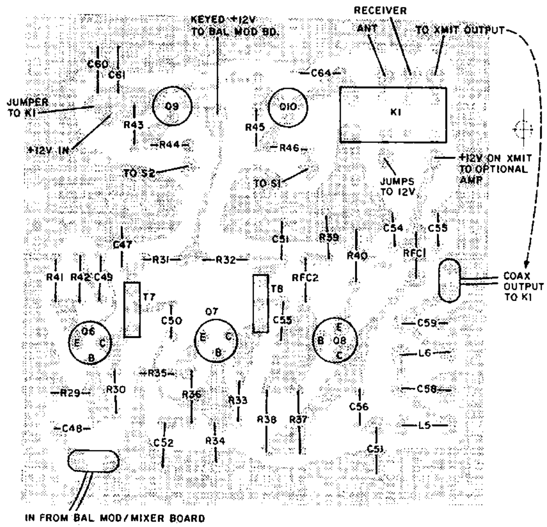


Figure 7 (a) The 1 watt amplifier/switching board. (b) Parts placement.

mitter with such a pad at the end of the bandpass filter, but found that the circuit was stable enough without it. Also, I wanted the 6 dB back! You may find that a pad at the end of the balanced modulator is not needed, and gain the energy otherwise lost heating the resistors.

The boards fit nicely into a Radio Shack cabinet. I double-decked the balanced modulator/mixer and amplifier boards on either side of a 10cm by 10cm PC board. The amplifier board is underneath because all the adjustable components are on the other board. You might consider making a cabinet of PC board material. It is drilled and cut easily, but plenty strong. If you can find a supply, you will save money on expensive cabinets. Done well, they can be lacquered or painted, and rival even the most professionally prepared cabinets in appearance. I also used a sheet of single-sided board as a false bottom in the cabinet. It helps establish a good ground plane.

Debugging and Tune-up

Viewed and constructed in modules, this rig can be assembled swiftly. Each module should be constructed and tested before moving on to the next. That way, a problem can be eliminated before it arises.

It is probably best to assemble this rig with access to a 35 MHz scope and frequency counter, if possible. If you are so lucky, your construction time will be drastically reduced.

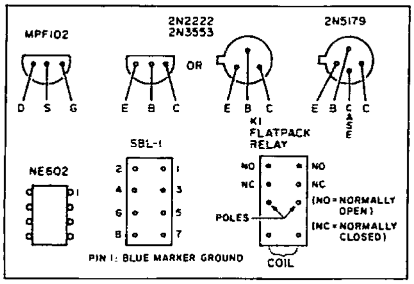


Figure 8. Base diagrams, all bottom view.

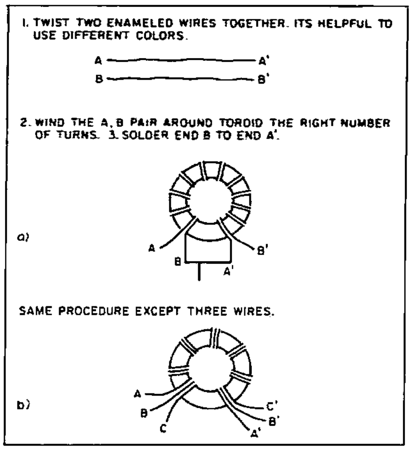


Figure 9. Winding the (a) bifilar transformer, and the (b) trifilar transformer.

Being able to see a signal on the scope and adjust the stage in question is a big help in a sideband project where you are concerned about speech waveform. If you do not have a scope, do not despair. You can probably adjust the transmitter a little at a time with the aid of the station receiver, its S-meter, and a sharp ear. I have adjusted RF stages this way, and while time-consuming, it can be done.

Construct the VFO and confirm that it oscillates at 6.5 MHz or so. Check this by placing the scope probe on pin 7 of IC 1. Confirm that the crystal oscillator, Q1, and its associated components, are running, by placing the probe at pin 1 of IC1. Tweak the output of the crystal oscillator with its trimmer capacitor. Before adding amplifier Q2, check to see that the product of the VFO frequency and the crystal oscillator is at 17.5 MHz or thereabouts. If the counter cannot "sit still" on a frequency, the desired product is not dominant. Tweak the IC's trimmer for maximum output at 17.5 MHz. Adding amplifier Q2 and tweaking its trimmer will further preselect 17 MHz and amplify it to about 3 volts peak-to-peak.

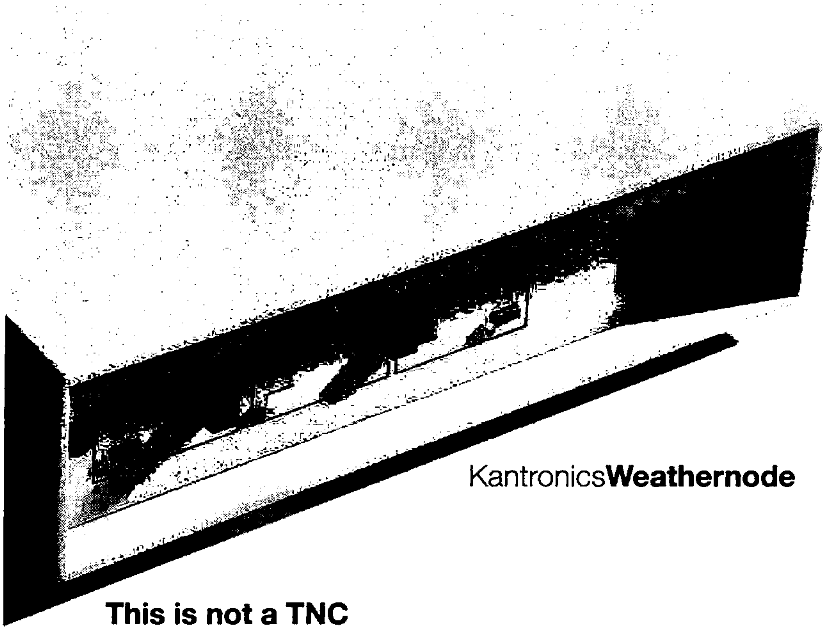
If you have no scope, you will have to find the oscillator's signal in the station receiver. Make sure you have the receiver's antenna lead close to the oscillator for adequate pick up. Adjust the same controls mentioned above for a peak S-meter reading.

C2 sets the VFO's bandspread at about 200 kHz. I chose 28.500 to 28.700 MHz, but adding a turn or two to L1 will lower the VFO frequency to the Novice portion of the band. Eliminating C2 will greatly increase the total bandspread.

Next determine that the balanced modulator carrier oscillator, Q4, will run. It is normally off except during spot and transmit periods, so you will need to temporarily apply voltage to it through its supply line resistor, R9. Peak its output. Plug in a microphone, adjust the audio gain (trimpot R27) for maximum input to T5 (clockwise) and holler. You should hear your best Donald Duck voice at 11 MHz, double-sideband. View the sideband carrier on the scope or listen to your signal n your station receiver and adjust the carrier balance trimmers (C23 and 24) potentiometer for the greatest carrier suppression. Even at maximum suppression, you will still hear a loud carrier in your station receiver. Adjusted properly, though, it will be undetectable by other stations. I have found that the audio gain trimpot is best set at about mid-range for best voice quality. Above that, significant clipping occurs.

The tricky part of the rig is the bandpass filter. The jumble of products from mixing the balanced modulator and VFO frequencies are all present at its input, and you must preselect the 28 MHz energy, pole by pole. Start first at the top of L2 and rotate the trimmer until you find a peak of 28 MHz waveform. Repeat this process at each pole. I have not tried this without a scope, and would expect this to be a rather frustrating part of the assembly if done by ear through the station receiver. Adjust the filter without voltage applied to the amplifier stages.

The rest of the circuit is broadbanded and not adjustble except for the lowpass filter. Final adjustment is made by tweaking every trimmer in the unit for maximum output on a wattmeter and spreading or compressing the turns on the coils in the low pass filter for greatest output. Take care that you do not



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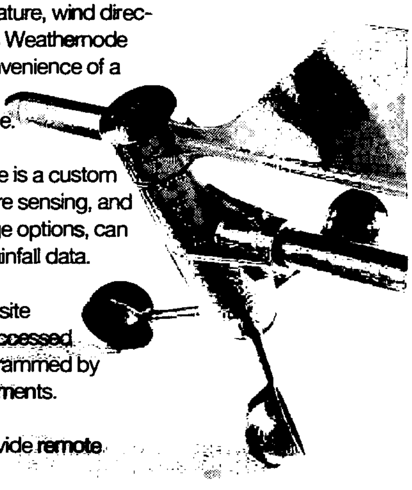

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Parts List

C1,9,12,14,17,19,28,29,31,36,47, 49,51,52,54,56,61,62,63,64	0.1µF
C10,15,20,21,25,26,30,48,50,53	0.01µF
C16,27,32,33,37,38,39,55,60	10 µF, 16V elec.
C11,57,58	100 pF
C2,13,18,22,41,43,45	60 pF "button" type trimmer
C3	10 pF or similar NPO or air variable trimmer
C4	100 pF NPO
C5	20 pF NPO
C6	35 pF air variable, panel mounted
C7,8	200 pF NPO
C23,24	10 pF trimmer, ceramic OK
C34,35	470 pF
C40	15 pF
C42,44	4.7 pF
C46	10.7 pF
C58	200 pF
R16,42,36	4.7 ohms
R32,40	10 ohms
R11,17,31	39 ohms
R4,7,28,35	47 ohms
R18,41,39	100 ohms
R10,12	150 ohms
R2,6,9,13,29,34,43,45	470 ohms
R21	1000 ohms
R37,38	1000 ohms, 1/2 watt
R33	1500 ohms
R3,5,14,23,30	2200 ohms
R19	3300 ohms
R26,44,46	4700 ohms
R20,24	22k ohms
R1,8,22,25	100k ohms
R27	1k ohm trimpot
R15	100 ohm trimpot
L1	24 turns, T-50-6 toroid
L2,3,4	13 turns, T-37-6
L5,6	8 turns, T-50-6 toriod
T1,4	Primary 33 turns; sec. 3 turns over drain end, T-50-2 toroid
T2	Primary 18 bifilar turns; sec. 3 turns over center of primary, T-37-6 toroid
T3	Primary 20 turns; sec. 3 turns over trimmer end, T-37-6 toroid
T5	10 trifilar turns, FT-37-43 toroid
T6,7,8	10 bifilar turns, FT-37-43 toroid
D1,3	1N914 or other small signal diode
D4,5	Schottky diode preferable, but 1N914 OK
D2	6V, 400 mW zener diode
Y1,2	11 MHz crystal
U1	NE602 balanced mixer/osc. IC
U2	741 single op amp
U3	SBL-1 diode-ring mixer module
Q1,3,4	MPF 102 FET
Q2	2N2222
Q5,6	2N5179 or 2N5109
Q7	2N3866
Q8	2N3553, 2SC2028, RCA 4013, 2SC2075, or equiv. transistors
Q9,10	2N4036 PNP switching transistor
K1	DPDT flatpack relay
S1,2	SPDT toggle switches
RFC1	15 microhenry molded choke
RFC2,3	10 turns, FT-37-43

Parts suppliers: *Tanner Electronics,* 1301 West Beltline Rd., Suite 105, Carrollton TX 75006. Tel. (214) 242-8702. Contact Jim Tanner regarding availability of kits. *Radiokit,* P.O. Box 973, Pelham NH 03076. Tel. (603) 635-2235. *Circuit Specialists,* P.O. Box 3047, Scottsdale AZ 85271-3047. Tel. (800) 528-1417. Blank PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. VFO board—$4.50; balanced modulator/mixer—$7; and amplifier board—$7; shipping—$1.50 per order.

detune the bandpass filter such that it is preselecting a different VFO/balanced modulator product. I tried to avoid this possibility by choosing an IF far removed from 28 MHz. While this results in the necessity of a mixing scheme in the VFO circuitry, it made tuning the bandpass filter easy. The first attempt at this circuit employed a 24 MHz IF and 4.5 MHz VFO. This sounded great in theory, but I had practical problems differentiating between 24 and 28 MHz signals.

Beware of self-oscillation. Even these broadband amplifiers will oscillate if overdriven, or if a mismatch occurs between stages. This will result in a waveform that looks like you have a carrier present in the signal. You may look to the balanced modulator for the problem, but you may really have an amplifier oscillating. I have used many different biasing and feedback schemes for Q7 and Q8, and the resistors in these stages should not be changed casually. While it is tempting to change them to obtain more output, you may start an otherwise stable amplifier oscillating madly. Experimenting with some of these components will show what a delicate balance exists in a sideband transmitter.

Adjusted properly, your voice will sound natural in the station receiver, and the wattmeter will bounce merrily with your speech patterns, resting at zero with no speech. If your wattmeter shows a continuous deflection during transmit periods, some imbalance

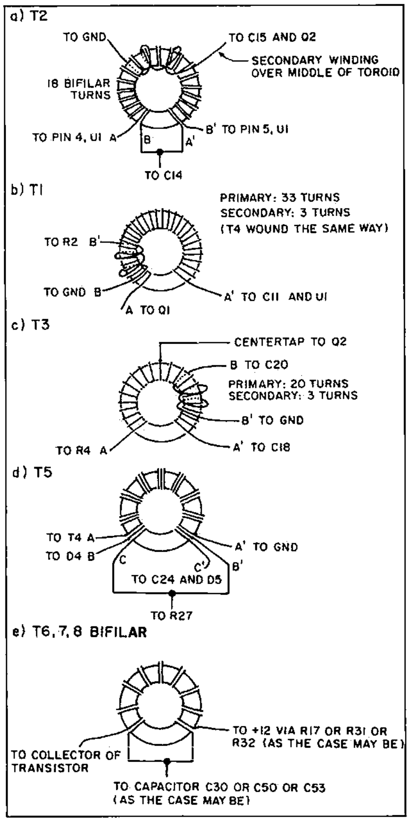


Figure 10. Winding specific toroids: (a) T2, (b) T1, (c) T3, (d) T5, and (e) T6,7,8.

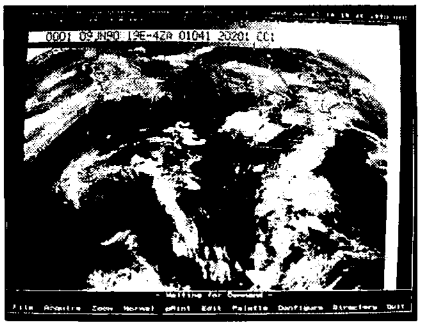
exists. Go through the adjustment procedure again, watching the wattmeter. You should have about a watt peak envelope power. In one version I had more, in another I had less.

The spot function is enabled by throwing S1. It turns on the carrier oscillator and enables you to tune the transmitter to your receiver's frequency without applying a signal to the antenna. Simply speak into the mike and adjust the frequency until your voice sounds natural.

On The Air!

Ten meters is wide open. After completing the breadboard version of this transmitter, I was immediately rewarded with an enjoyable 1500 mile QSO on the first call. I had the same luck the next day. I have a modest beam antenna at a modest height. You will be pleasantly surprised at what a watt will do on 10 meters. While this rig will not duplicate the performance of the commercial transceivers, it performs admirably. Most importantly, it shows that a non-engineer and non-technician, on a first attempt at a sideband transmitter, can cook up a workable system. If I can do it, so can you! I welcome correspondence regarding this rig or any home-brew topic. Happy home-brewing!

You may contact Bruce Auld NZ5G at 1704 Windsor Forest Trail, Roanoke TX 76262. Please enclose an SASE.



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CIRCLE 132 ON READER SERVICE CARD

Simple Gain Antenna for 903 MHz

Build it for under $25.

by Phil Salas AD5X

Building antennas for the UHF and low microwave bands generally requires quite a bit of metal work and some tricky adjustments to get good results. However, you can overcome some of these problems with a few relatively simple modifications to an inexpensive, commercially available TV antenna.

The antenna I used was the Radio Shack U-75 UHF corner reflector antenna (RS 15-1660), which costs just $16.95. It consists of one driven element and seven directors. (This antenna is actually called a "corner-Yagi-Uda-hybrid" antenna, which is a corner reflector antenna with directors.) The trick was to match this antenna to 50 ohms and optimize it for the 902–928 MHz ham band.

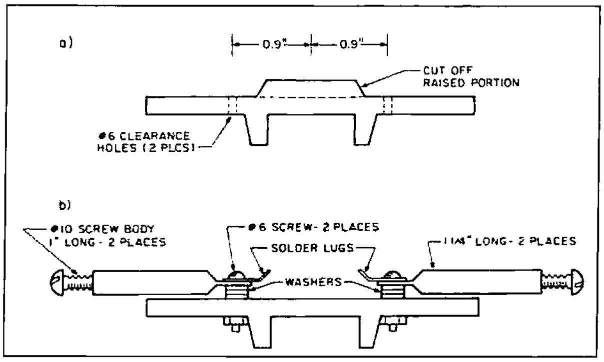

Figure 1. (a) Preparation of the plastic center piece. (b) Driven element preparation.

The Modifications

First, you must remove the insulated driven element by drilling out the center rivet holding it in place. Next, remove the aluminum elements from the insulated driven element by drilling out the two rivets holding them on. You should now be left with just the blue insulated piece. Now, referring to Figure 1(a), cut off the raised portion of this insulated piece with a hacksaw or band saw. Finally, measure 0.9 inch from the center hole and drill two holes for clearing #6 screws. This completes the modifications to the insulator.

Referring to Figure 1(b), cut two 1¼-inch pieces of ¼-inch copper tubing and flatten ½ inch of one end of both pieces. Drill a #6 clearance hole in the flattened portion on each tube. Attach these two tubes to the insulator with two #6 screws, nuts, solder lugs, and six #6 washers, as shown. Next, take two #10 x ¾-inch brass screws and insert them about halfway into the two copper tubes. Crimp the copper tubes so that the screws are snug in place. A type "F" TV connector crimping tool is excellent for this. This completes the driven element. Now, turn the screws completely into the tubes.

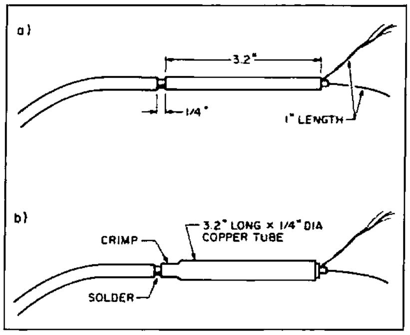

Figure 2. (a) Sleeve balun construction. (b) Crimp the balun and solder equal length leads onto the balun sleeve and center conductor.

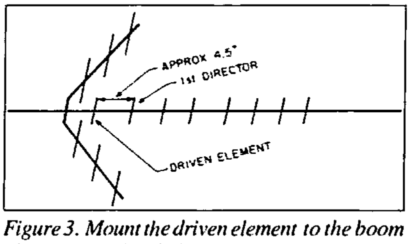

Figure 3. Mount the driven element to the boom about 4.5 inches behind the first director.

The Match

The driven element will just be a simple half-wave dipole which should give a good match to 50 ohms. However, the dipole is balanced and the coax is unbalanced so a 1:1 50 ohm balun is in order. Figures 2(a) and 2(b) show the construction of the balun. Use RG-8M coax cable (available also from Radio Shack). RG-8M is a miniature RG-8 coax which has an impedance of 50 ohms and the same diameter as RG-59. The loss characteristics of RG-8M are far superior to RG-58 and it is a perfect fit in the ¼-inch copper tubes.

Referring to Figure 2(a), prepare one end of the RG-8M by first stripping off 1 inch of insulation and exposing the braid and center conductor. Next, measure 3.2 inches more and remove a ¼-inch section of insulation, as shown. Now, cut a 3.2-inch piece of ¼-inch copper tubing and insert it over the cable, as shown in Figure 2(b). Overlap about half of the exposed braid and crimp the copper tube to hold it firmly in place. Using a 100 watt or more soldering iron or gun, carefully solder the tube to the section of braid. The open end of the tubing should be comfortably removed (0.1 inch or more) from the braid and center conductor. Now, cover the exposed braid/soldered tubing end and the entire piece of copper tubing with heat shrink tubing (from Radio Shack) and heat to shrink in place. You have just created a quarter-wave (3.2 inches at 915 MHz) 1:1 sleeve balun.

Now, solder the center conductor to the solder lug on one of the elements of the driven element assembly, and solder the braid to the other solder lug. Keep the lengths of the braid

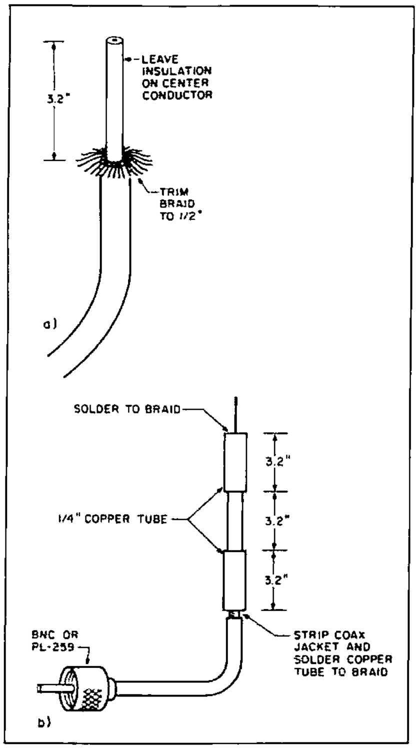

Figure 4. (a) Prepare the coax for the half-wave reference antenna. (b) Attach the sleeve and the RF choke sections of tubing as shown.

and center conductor as short as possible and equal in length.

At the other end of the RG-8M, add either a BNC or a PL-259 UHF connector. In either case, purchase a connector for RG-59 cable as it has the same basic dimensions as the RG-8M coax. A PL-259 with RG-59 reducer is the easiest connector to install. If you use a BNC connector, you will have to trim several of the center conductor strands from the RG-8M cable in order to insert the RG-8M coax center conductor into the BNC pin.

Finally—The Adjustment

To adjust the antenna, you will need a signal source and either an antenna bridge or an SWR meter. First, hold the driven element assembly out away from you and adjust the screws in no more than quarter-turn increments for minimum SWR of less than 1.5:1.

Now, place the driven element assembly on the antenna 4.5 inches behind the first director, as shown in Figure 3. Hold it in place with an 8-inch nylon wire tie (Radio Shack 278-1652). Watch the SWR and minimize it by carefully sliding the driven element assembly. If necessary, adjust the screws in the driven elements slightly. You should be able to get very close to a 1:1 SWR. Now, use either epoxy or hot glue to hold the driven element assembly permanently in place. You could also drill a new mounting hole through the boom and bolt the element in place. Also, re-crimp the copper tubing over the brass screws to make sure they stay put and make good electrical contact.

Reference Antenna

To see how much gain this antenna was really giving me, for comparison I built a half-wave sleeve dipole with an RF choke to isolate the coax from the antenna field. Figures 4(a) and 4(b) detail its construction.

Expose 3.2 inches of the INSULATED center conductor from a length of RG-8M coaxial cable. Unravel the braid and trim it to a length of ½ inch. Cut two 3.2-inch lengths of ¼-inch copper tubing. Slip one piece over the center conductor and down over the coax cable so that the RG-8M braid is under the tubing. Crimp the tubing with an "F" type crimping tool to hold it in place, and solder the tubing to the braid.

Slip the other 3.2-inch piece of copper tubing over the other end of the coax cable, positioning it 3.2 inches from the first tube. Carefully remove a band of insulation from the RG-8M, then crimp the tube over the braid and carefully solder the copper tube to the braid. Cover the entire assembly with heat-shrink tubing. Finally, add either a BNC or a PL-259 connector to the end of the RG-8M coax cable.

Attach a signal source and an SWR meter and snip off small increments of the center conductor until you have an SWR of less than 1.5:1. If you overshoot, just solder an extension wire to the center conductor and try again.

Measurements

My antenna-measuring setup consists of an ICOM R-7000 receiver with a Smith Design Spectrum Probe™ connected to the R-7000 10.7 MHz IF output. This gives me a tunable spectrum analyzer. I use a telescoping whip antenna for the R-7000 receiving antenna. Anything will work for this antenna as you are just going to look at the relative difference between the reference antenna and the corner reflector.

First, I supported the reference antenna about 20 feet from the R-7000. Then I connected a signal source to the reference antenna and made a note of the level on both the R-7000 S-meter and the Spectrum Probe oscilloscope output. Next, I connected the corner reflector and made boresight gain, side lobe suppression, and front-to-back ratio measurements. My setup is fairly crude, but I believe that the following figures are accurate to within 3 dB:

Gain:	8 dB
Side Lobe Suppression (90 degrees):	10 dB
Front-to-Back Ratio:	15 dB

An Inexpensive Solution

The gain antenna itself can be built for less than $25. Two higher gain corner reflector antennas are available from Radio Shack should you wish higher gain. The construction and set-up techniques in this article should be applicable to any of these antennas. 73

Contact Phil Salas AD5X at 1517 Creekside Drive, Richardson TX 75081.

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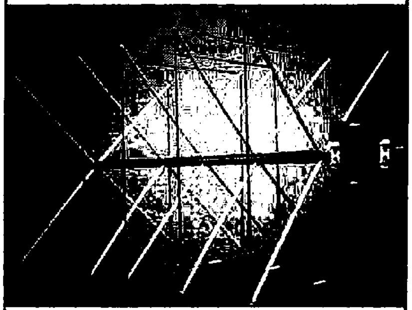

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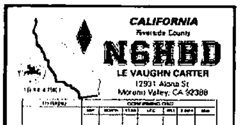

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CIRCLE 44 ON READER SERVICE CARD

Microprocessor Repeater Controller, Part I

Add versatility to your repeater system.

by John Bednar WB3ESS

Not long after publishing an article on my Link Controller in the December 1989 issue of *QST*, I realized just how many repeater owners needed a repeater controller they could home-brew on a modest budget. My first single-chip microprocessor repeater controller had been in operation for almost 10 years. Before offering it to others, however, I decided to completely rewrite the software to add some new features. I knew that if the design were economical, it would bring those repeater owners with diode matrix IDers and intermittent touchtone control into the 21st century.

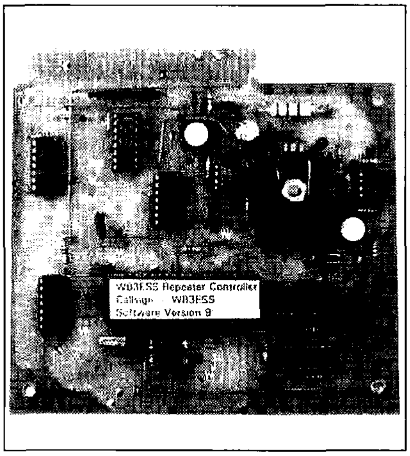

Photo A. The repeater controller consists of a computer board and an audio board. Shown above is the microprocessor board.

Selected Features

The heart of this controller is an 8749H single-chip microprocessor. To date, I am still amazed at how many features I was able to pack into it! Selecting the features required prudence, since the memory of the 8749H is limited to 2K bytes of EPROM. You could add external memory, but that would increase the size and cost of the finished product. It would also produce RFI, and you would have to mount the controller in a shielded box with feed-through capacitors to bypass the wires.

See Table 1 for a list of the features I selected. Macro capability, voice messages, reverse auto patch, and measurement of signal strength would be nice extras, but you'd spend seven to ten times more. The project in this article is for those who want an economical, easy-to-construct repeater controller with a wealth of useful features.

Overview of the Controller

The complete repeater controller consists of two circuit boards, one with the microprocessor circuits and the other with the audio and phone interfaces. With a modest junk box, you can build both of them for approximately $130. (I will be making the boards and programmed microprocessors available.) The microprocessor board (see Photo A) has nine outputs and two inputs for control and monitoring. All of these outputs are reserved for the user; they are not dedicated to any specific task.

Additional controller outputs are provided for autopatch, audio muting, repeater PTT, link PTT, and two outputs for the Link Controller Host PTT and Busy inputs. All user outputs are open collector type, able to withstand 30 volts, and sink 40 mA of current. The repeater controller has inputs for repeater CAS, link CAS, superuser, and link monitor, plus two reserved inputs for users to monitor things. All repeater controller inputs are CMOS, and offer a wide input voltage range to make interfacing easy.

Command Structure

The repeater controller has two priorities in the DTMF command structure: the "user" and "superuser" levels. None of the superuser commands can be executed when the controller is in the user mode, but all of the commands can be executed in the superuser mode. What's even nicer is that the owner can assign these priority levels to all of the 39 commands!

In most cases, you don't have to use the commands to change the CW speed, key-up delay, and hang-time available to all users. By restricting these and similar commands to superuser priority, they can not be executed unless the repeater controller is in the superuser mode.

When entering a command with superuser priority, the superuser pin must be low. If this pin input is high, only the lower priority user commands can be executed. This input pin can be connected to many different sources, the simplest being a controller output. Since output #1 is adjacent to the superuser pin, a solder ball across these two pins on the card edge connector will make the connection.

Another interesting source for the superuser input is a PL tone decoder output. With this type of connection the control operator would turn on a subaudible tone to enter superuser commands. With this type of external control of the command priority, the owner can adapt the repeater controller to whatever level of security is necessary for the environment.

Courtesy Beeps

When the repeater controller is in the non-link mode, you can choose a very short single beep, a short two-tone beep, or a no-courtesy beep. The decision to use the short single beep or the two-tone beep is based on whether output #9 is programmed high or low. I use this output to signal repeater users on whether a repeater function is on or off. By using this output to control some

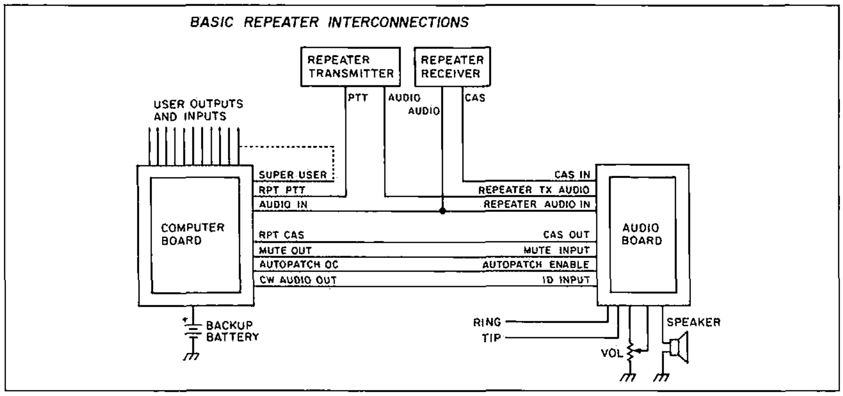

Figure 1. Block diagram of a basic repeater system using the repeater controller.

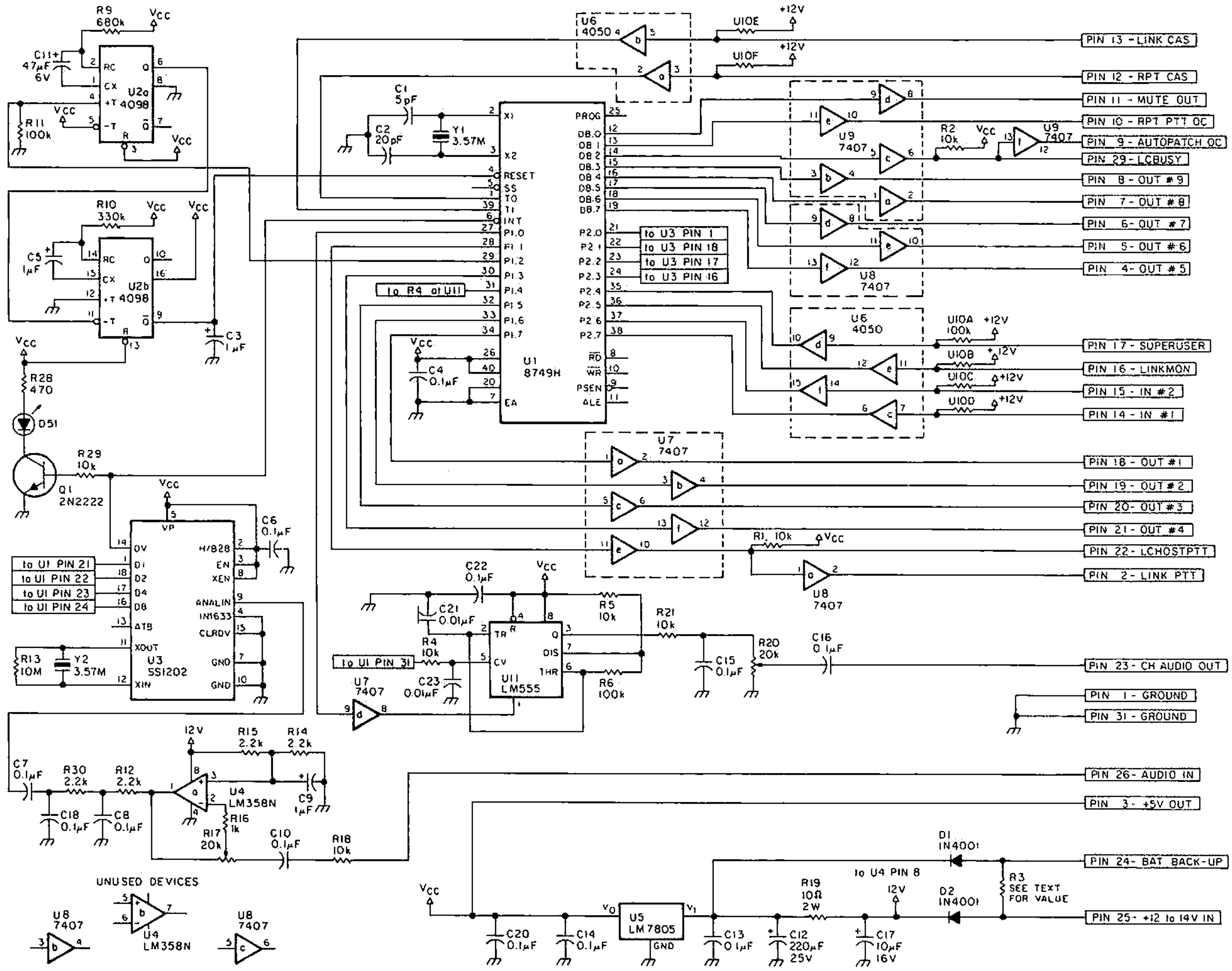

Figure 2. Schematic for the repeater controller computer board.

function, you can let your users know the on/off status of the function.

For example, you could use output #9 to turn the PL on and off. If you don't like courtesy beeps, you can simply program the courtesy beep delay to zero, and it won't sound during non-link operation! The link monitor input puts the repeater controller in the link mode via local or external control. (The repeater controller and hardware in this article is optimized for a repeater with a single link. You can add multiple links, but you have to build more hardware. I will include this information with kit orders.)

With this link monitor input, you can have an external device like a Link Controller turn the link on when a remote user wants to link into your repeater from another frequency. In link mode (linkmon input low), the computer uses an alternate set of courtesy beeps to let your users know that a link is enabled. If a user unkeys from the repeater frequency, a short double beep is sent; however, if a user unkeys from the link frequency, a dash-type beep is heard on the repeater. This simple selection of the courtesy beeps during linking operation instantly informs the users where the signals are coming from.

For additional flexibility, the pitch of the courtesy tones can be varied by changing components in the tone oscillator circuit (U11). Finally, if a user keys the repeater during the courtesy beep, the computer stops the tone so it won't interfere with conversation.

DTMF Features

Continuing with more features, the repeater controller can accept DTMF commands anytime, *even when sending CW.* When entering a command, the first digit must be valid for at least 200 ms. This is done to reduce the possibility of the controller being "triggered" by normal speech. Because of this delay, a short burst of the initial DTMF tone will be heard on the repeater, but all remaining DTMF tones will be muted.

Like the Link Controller, the repeater controller DTMF commands can be executed immediately by placing a "#" at the end of a command string. This feature can be used to control the repeater in the presence of other signals, or to string commands together. Normally, all DTMF tones are muted on the repeater and the link; however, by beginning a DTMF string with a "*" all remaining DTMF tones are transmitted over the repeater and link frequencies until the user unkeys.

This is useful for sending DTMF tones to a remote Link Controller board or some other external device. No need to worry about the initial burst of the "*" digit mixing up a remote Link Controller. Every Link Controller is already programmed to ignore invalid leading digits! Finally, an internal timer clears the DTMF digit buffer if the user doesn't unkey within three seconds of the last digit entered. This timer will aid the control operator if errors are made when commanding the repeater controller in the presence of other signals. If an error is made, the control operator simply waits three seconds and then re-enters the command.

Table 1. Repeater Controller Features

- Station ID, time-out timer, DTMF touchtone muting
- Nine outputs and two readable inputs for the user
- Programmable CW speed, hang-time, key-up delay, and courtesy beep delay
- Four-digit commands with programmable prefixes
- Programmable CW on/off read-back messages
- Programmable dual-priority level command structure
- Disable/enable repeater transmitters, link transmitter, time-out timer, and DTMF decoder.
- Autopatch and linking features
- Direct connect outputs for the Link Controller (uses commercial circuit boards and common parts)
- Multiple audio inputs and outputs with audio gating
- Phone interface, PL gating, and local speaker output
- All software, I/O, and timers are contained in one chip!

ID & Timeout

The repeater controller has a fixed ID interval of seven minutes, and the repeater will ID only when nobody is talking—unless the time-out timer ID is disabled. When disabled, the repeater will ID whenever the interval timer reaches zero (while users are talking).

To save valuable memory and eliminate extra transmissions by the repeater controller, I did not program the controller to do an "end ID." This is the type of ID routine where, a few minutes after the QSO has ended, the controller sends the station callsign and sometimes an extra message. I personally like a repeater controller without lots of chatter, and that weighted my decision.

To help reduce repeater key-ups caused by intermod bursts and dialing kerchunkers, I added programmable key-up delay to the software. When the repeater is being used, the key-up delay is unnoticeable. But after 30 seconds of no activity, the controller switches to the programmable key-up delay value, which is adjustable from 0 to 2.6 seconds.

The repeater controller time-out timer is fixed at the legal maximum of three minutes. Before the repeater times out, the controller sends a message to the users with a station ID. If the user is still talking, the transmitter, link transmitter, and phone patch are turned off. The transmitters stay off until the offender unkeys and realizes his mistake and transmits again.

There is no post time-out harassment from the repeater controller; that task is left up to the repeater users. Of course, if the repeater is timed out, a control operator can enter the command to disable the time-out timer, and the repeater transmitter will come on again. To be successful, the control operator must be able to capture the repeater receiver. The "#" feature must be used.

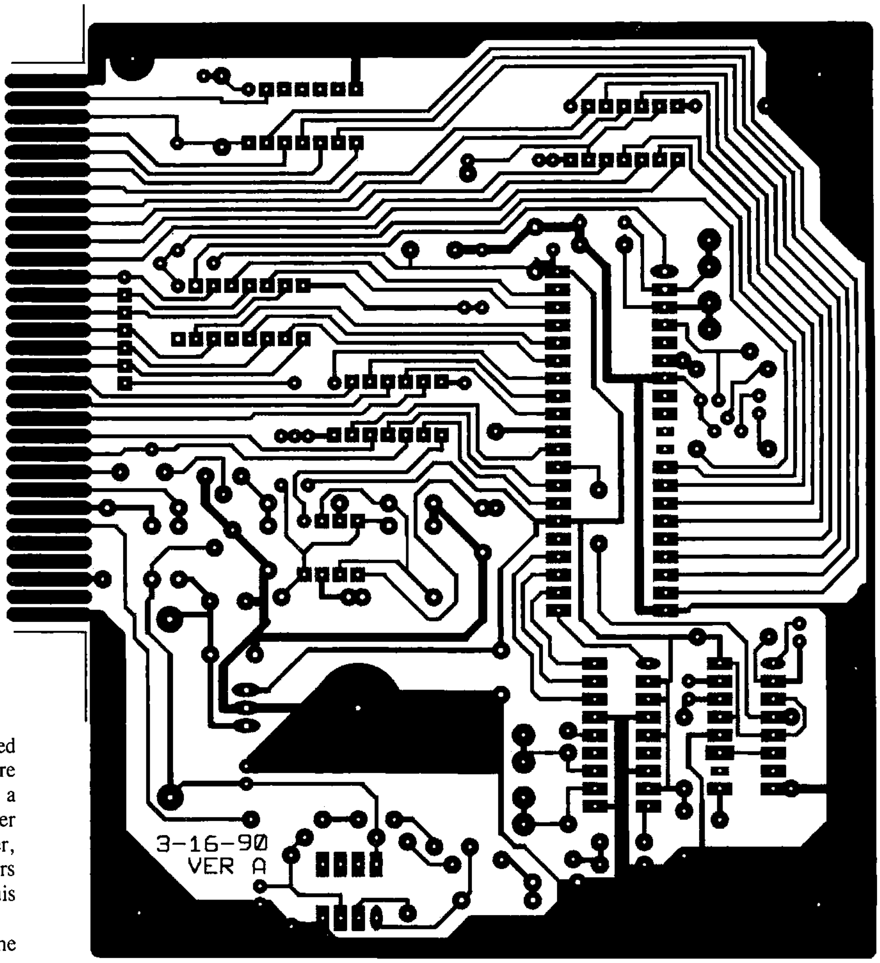

Figure 3. PC foil pattern for the computer board.

Table 2. Commands

Command Function	Powerup Priority
Output # 1 low	User
Output # 1 high	User
Output # 2 low	User
Output # 2 high	User
Output # 3 low	User
Output # 3 high	User
Output # 4 low	User
Output # 4 high	User
Output # 5 low or pulsed	Superuser
Output # 5 high	Superuser
Output # 6 low or pulsed	Superuser
Output # 6 high	Superuser
Output # 7 low or pulsed	Superuser
Output # 7 high	Superuser
Output # 8 low or pulsed	Superuser
Output # 8 high	Superuser
Output # 9 low, two tone beep	Superuser
Output # 9 high, single beep	Superuser
Read input # 1	Superuser
Read input # 2	Superuser
Autopatch on	Superuser
Autopatch off	Superuser
Increase keyup delay	Superuser
Decrease keyup delay	Superuser
Increase CW speed	Superuser
Decrease CW speed	Superuser
Increase courtesy beep delay	Superuser
Decrease courtesy beep delay	Superuser
Increase hang time	Superuser
Decrease hang time	Superuser
Disable time out timer	Superuser
Enable time out timer	Superuser
Disposable repeater	Superuser
Enable repeater	Superuser
Disable DTMF decoder	Superuser
Enable DTMF decoder	User
Disable link transmitter	Superuser
Enable link transmitter	Superuser
Change command prefix	Superuser

Autopatch

The repeater controller phone patch support is basic but novel. There really isn't enough memory to implement long distance lock-out, reverse patch, auto dial, or control from the phone. Despite this, the controller has several nice autopatch features.

For instance, when dialing the phone number, all digits are muted so that repeater listeners are unable to hear it. Additionally, there is an input on the computer board that allows owners to customize the autopatch with long distance lock-out or a patch limit timer if needed.

During autopatch calls, the microprocessor monitors input #2. If this input is pulled low, the autopatch will be terminated as if the OFF code had been entered from the touchtone pad. Since this input is scanned only when the microprocessor is not sending Morse code, the external signal will have to be latched until the patch goes off for correct operation.

Due to some clever software, this input functions identically to input #1 during non-autopatch periods. Therefore, input #2 may be *multiplexed* for both functions. The above features, plus being able to lock out users with the superuser priority, should aid control operators.

DTMF Commands

Initially, every repeater controller powers up with the same set of default commands. All commands are fixed at four digits long, except the editing commands, which are eight digits long. Since the leading two digits of each command can be edited, unique command sets can be created.

Because the repeater controller has two command priority levels, it's not absolutely necessary to change the prefix of all 39 commands. By making the access to the superuser function unique, 30 of the commands are instantly protected from outside parties (30 of the commands power up with superuser priority).

All commands are listed in Table 2, along with the power-up priority of the command. Most of these commands are self-explanatory. The four pairs of increase/decrease commands simply change timing values in the software. The owner can use a touchtone pad to increase or decrease timer values in fixed increments. The command can be repeated to make larger changes.

I chose this method for two reasons—it keeps the operation simple and it conserves precious memory. Although it's not as glorious as pro-

gramming delays in milliseconds, the result is identical. Also, my first repeater controller used this method of changing delay parameters, and it has worked well to date.

Command Editing

All of the controller commands have CW read-back to confirm the action, except for the autopatch ON command where it wouldn't make sense. To make the interfacing easier to the user inputs and outputs, I thought it would be convenient if I could control the *sense* of the CW read-back message. The power-up standard is output/input—high reads back as OFF and low reads back as ON.

If you like, you can reverse these messages when you're programming the prefix codes. Once again a simple but effective method was chosen to do this. To keep the standard read-back messages, program a 1, 3, 5, 7, 9, or A as the first digit of the prefix. To reverse the read-back messages, program a 2, 4, 6, 8, 0, #, or B as the first digit of the prefix. To eliminate the read-back message entirely, program a C or D as the first digit.

Since the "*" is reserved to pass touch tones, it can not be used as a valid first digit. If an "*" is programmed as a leading digit by mistake, simply program a new prefix with a different leading digit to correct the error.

You can program outputs #5 through 8 for pulsed low operation or a static (no pulse) function. Because of memory limitations, pulsed operation could only be added to the *output low* commands of these outputs. If a leading prefix digit of 1,2, or D is programmed, the output will pulse low for 150 ms and then return to a high state. Also, these three digits allow the owner to select one of the three possible read-back messages. If any other leading prefix digit is programmed, the output will behave like the other outputs (no pulses).

I am sure this flexibility in read-back messages is welcomed, as you don't have to invert signals in hardware to make the CW read-back message correct.

Since the above method worked so well, I decided to use the same scheme to program the command priority. To designate the command as user priority, simply select a 1, 3, 5, 7, 9, *, A, or C as the second digit of the command prefix; and as a superuser priority, select a 2, 4, 6, 8, 0, #, B, or D as the second digit.

To program a new prefix code into the controller, simply touchtone the following eight-digit sequence without unkeying: the four-digit "change command" code, and the two-digit "code number," and "new two-digit prefix." The software counts the number of digits entered, then checks the code number range. If no errors are detected, an "R" will be heard when unkeying, to confirm the change of prefix. Remember, the controller will clear the command buffer if you pause for more than three seconds between digits. If editing becomes necessary in the presence of other signals, just use the force feature "#" at the end of the eight-digit sequence.

All modifications to the power-up state of the controller are saved in the computer's RAM. Since the 8749H power-down feature wasn't usable in this design, I decided to provide battery backup power to the entire board. Everything needed for this is on the computer board, including the diode switch and the charging resistor (R3) for the battery pack. The computer board requires approximately 225 mA, so a pack of seven AA NiCd batteries will keep the board alive for close to three hours. If longer periods of backup are required, you can substitute a backup battery with greater capacity. To allow the charging circuit to function properly, the full charged terminal voltage of the battery must be at least 1 volt less than the power supply voltage of pin 25 on the card edge connector. If you notice that your computer doesn't retain programming changes after power loss, measure the voltage across R3 to see if charging current is flowing into the battery under normal conditions. For those owners who have a 6 volt battery pack lying around, a high efficiency regulator can be substituted for U5 (LM2940CT-5.0). With this regulator, the terminal voltage of the backup battery can be as low as 6.1 volts. Resistor R3 should be selected according to the battery backup scheme you use. If you power the computer board with a 13–14 volt supply, R3 should be 390 ohms (you can use either voltage regulator) when using a seven-cell AA NiCd pack; R3 should be 470–510 ohms if you use a six-cell AA NiCd pack (use the optional regulator). See the parts list for a good backup battery source.

Computer Board Operation

The heart of the computer board is the microprocessor U1. It controls the entire repeater controller. The inputs to the microprocessor are buffered by a 4050 IC (U6) and the outputs are buffered by 7407 open collector buffers (U7, U8, and U9). Pull-up resistors in a SIP resistor pack (U10) pull all the inputs to an idle state if the pins aren't connected. The board uses a 555

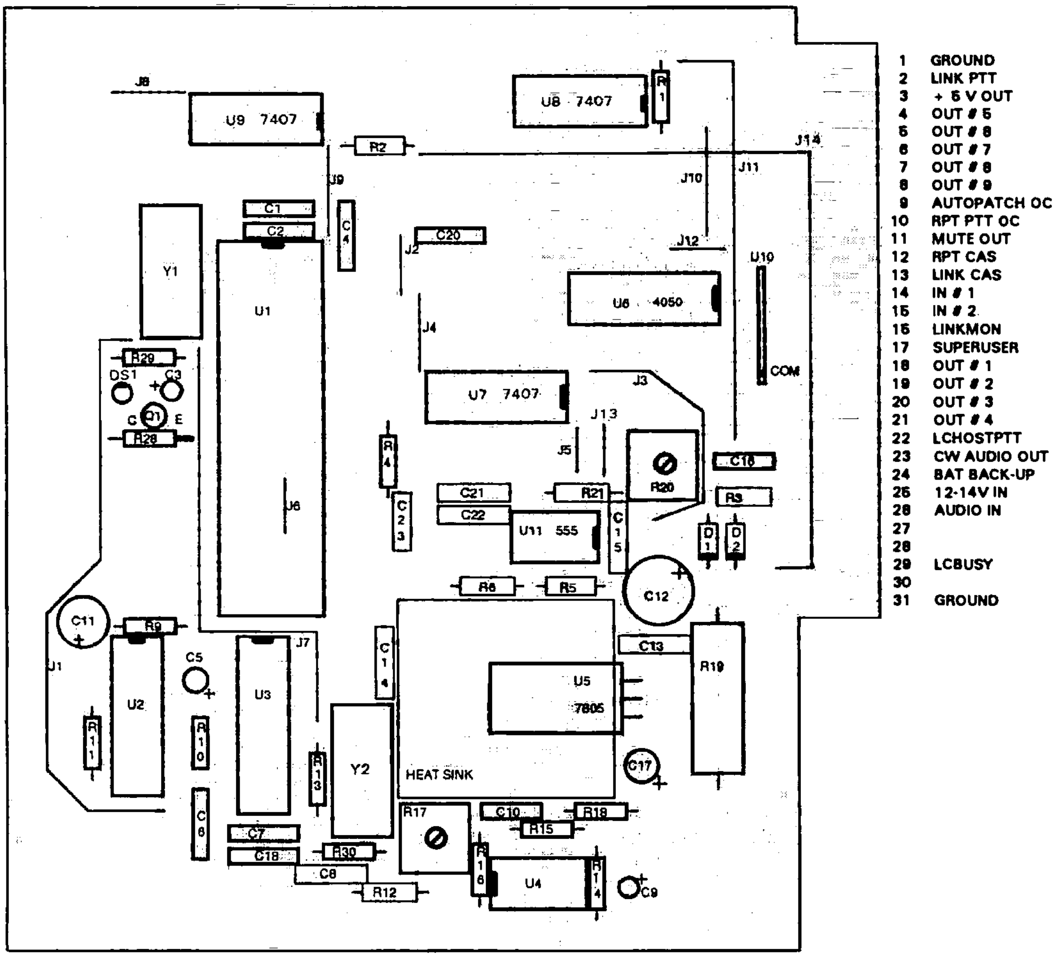

Figure 4. Computer board parts placement.

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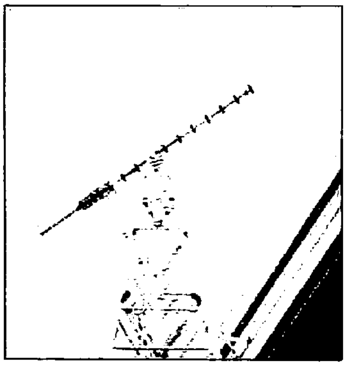

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oscillator circuit (U11) to generate the CW tones for all IDs and messages. The resistors and capacitors in this circuit can be changed to modify the waveform and frequency. To change the pitch of the tone for some IDs and courtesy beeps, the microprocessor pulls pin 31 low. Resistor R21 and capacitor C15 form an RC filter for the tone oscillator, and pot R20 is used to adjust the CW ID level.

The computer board uses a DTMF decoder (U3) and an associated audio buffer (U4) to decode the DTMF tones. The gain of the circuit is controlled by pot R17. A filter after the op amp (R30, R12, C8, and C18) rolls off discriminator audio before passing it to the decoder chip. When the decoder chip thinks it detects a valid DTMF tone, pin 14 of U3 goes HIGH, signaling the microprocessor and lighting the LED DS1. Occasionally this LED may flash briefly during normal speech. If it occurs at a high rate, the filter after U4 may have to be modified.

The watchdog circuit (U2) monitors the microprocessor and resets the computer if the program stops execution. Pin 4 of U2 is continually pulsed by the microprocessor. If the program stops execution, these pulses will disappear, and after 8–15 seconds of delay, the watchdog should reset the microprocessor. When this happens, a power-up message will be sent on the repeater, and all default commands and parameters will be reloaded into memory.

It's important to connect a DC backup source to the battery backup pin to protect the microprocessor from being reset and loading the default parameters. Without a backup battery, power supply glitches may occasionally scramble both the microprocessor and the watchdog circuit. These cases are rare and they seem highly dependent on the transient suppression of the main DC supply.

The remaining circuits on the board provide regulated 5 volts to the board. If the supply voltage drops, the backup battery will provide power to the board through diode D1. Diodes D1 and D2 form a DC switch, and resistor R3 charges the external backup battery. If a nonchargeable battery is used, this resistor must be removed.

Table 3. Computer Board Parts List

Part	Description	Source
C1	5 pF ceramic capacitor	Mouser 21FK005
C2	20 pF ceramic capacitor	Mouser 21FL020
C3,5,9	1.0 µF tantalum	Mouser 540-1.0M35
C4,6,7,8,10,13,14, 15,16,18,20,22	0.1 µF ceramic	Mouser 140-CD12R6-104Z
C11	47 µF, 6V tantalum	Mouser 540-47M06
C12	220 µF, 25V electrolytic	Mouser 140-XR35V220
C17	10 µF, 16V tantalum	Mouser 540-10M16
C21,23	0.01 µF ceramic	140-CD50Q6-103Z
D1,2	1N4001 diode	Mouser 333-1N4001
DS1	LED, any color	Mouser 35BL501
Q1	2N2222 NPN transistor	Mouser 511-2N2222
R1,2,4,5,18,21,29	10k, 1/4 W	Mouser 29SJ250-10k
R3	see text	see text
R6,11	100k, 1/4 W	29SJ250-100k
R9	680k, 1/4 W	Mouser 29SJ250-680k
R10	330k, 1/4 W	Mouser 29SJ250-330k
R12,14,15,30	2.2k, 1/4 W	Mouser 29SJ250-2.2k
R13	10MEG, 1/4 W	Mouser 29SJ250-10M
R16	1k, 1/4 W	Mouser 29SJ250-1k
R17,20	20k potentiometer, single turn	ME323-4255P-20k
R19	10 ohm, 1 or 2 W	Radio Shack 271-151
R28	470 ohm, 1/4 W	Mouser 29SJ250-470
U1	8749H microcontroller	WB3ESS; see note below
U2	4098 IC	Mouser 511-4098
U3	SSI202 Touchtone decoder IC	Radio Shack 276-1303
U4	LM358 IC	Mouser 511-LM358N
U5	7805 voltage regulator (see text)	Mouser 511-L7805ACV
U6	4050 IC	Mouser 511-4050
U7,8,9	7407 IC	526-NTE7407
U10	100k, 10-pin SIP	Mouser 266-100k
U11	555 timer IC	Mouser 511-NE555N
Y1,2	3.57 MHz crystal	Radio Shack 272-1310
1	PC board	WB3ESS RCCB3-16-90-A
1	40-pin IC socket	Mouser ME151-8040
2	15-pin IC sockets	Mouser 15IC016
1	18-pin IC socket	Mouser ME151-8018
3	14-pin IC sockets	Mouser 15IC014
2	8-pin IC socket	Mouser 15IC008
1	TO-220 heat sink	Radio Shack 276-1363
1	Card edge connector 31/62 (mounting holes)	Digi-Key S1312
	Alternate edge connector (no mounting holes)	Radio Shack 276-1453

Parts are available from: **Digi-Key Corporation**, 701 Brooks Ave. South, P.O. Box 677, Thief River Falls MN 56701-0677. Phone: (800) 344–4539; and **Mouser Electronics**, 12 Emery Avenue, Randolph NJ 07869. Phone: (800) 346–6873.

The computer and audio blank PC boards and a programmed 8749H microcontroller chip are available for $19 each from John Bednar WB3ESS, 548 Cherryville Road, Northampton PA 18067. When ordering the programmed microprocessor, please include the repeater call as you want it sent, including the prefix (de) and suffix (/rpt) along with all spaces clearly marked. SSI 202 touchtone decoder chips are available in limited supply for $7. Please add $4 shipping for all orders. Foreign orders should include additional postage.

If you want to program your own controller IC, the source code is available in DOS format from the author at the above address. Send $10 and a formatted floppy (any size, any density). If you write the author requesting information, please enclose an SASE.

For battery backup, an assembled 7-cell NiCd AA battery pack is available from Cunard Associates. Phone: (814) 623-7000.

Assembly and Test Instructions

Before you begin assembly, here are some pitfalls to watch out for:

1. Don't attempt to assemble this board with a high temperature soldering iron or gun.
2. If the LED DS1 is installed backwards, it will give you the impression that the touchtone decoder isn't working.
3. Make sure resistor pack U10 is positioned correctly, and of the correct type (one common pin and the resistors internally tied to this pin).
4. Be aware that not all the ICs are oriented in the same direction.

Begin assembly by installing the 14 jumpers. Don't miss jumper J6; it's located under U1, an IC. Follow this by adding all IC sockets. It's important to install a socket for U1 so that the chip can be removed without damage and reprogrammed if necessary. Next, install the voltage regulator and heat sink and put a little heat sink compound on the regulator tab to aid in the heat transfer. Bolt the regulator and heat sink firmly to the PC board. Finish the board assembly by adding all remaining components.

Perform the initial testing with the ICs removed. Apply 12–14 volts to the +12V IN and GROUND pins of the board, and measure the regulated +5 volts at pin 40 of U1. If the supply voltage isn't within 0.25 volts of +5 volts, measure the voltage drop across R19. If this voltage drop is greater than 4 volts, look for a shorted trace somewhere on the board. Once the voltages are correct, remove the power and insert all ICs. Reapply power and re-measure the supply voltage. With all ICs installed, it should still be within 0.25 volts of +5 volts.

The computer board sends a power-up ID whenever the computer is powered up or reset. This power-up ID can be used to check the initial operation of the computer board. Two test methods will be given; the first requires an oscilloscope and the second a voltmeter. Connect a scope probe to pin 23 of the board and apply power. While monitoring the CW AUDIO OUT pin, the CW power-up message should be visible on the scope. If no tone is observed, it's possible that the microprocessor isn't running, or the 555 tone circuit is nonfunctional. The second test method checks to see if the microprocessor is running. First connect a resistor (anything between 1k and 10k) between pins 3 and 10 of the computer board, and attach a voltmeter between pin 10 and ground. When the board is powered up, the voltage on pin 10 should drop to near zero volts. After 6–8 seconds, this voltage should rise to near 5 volts. If this doesn't happen, the microprocessor isn't running or U9 is faulty.

When the above tests are successful, the watchdog operation should be checked. Using either test configuration from above, place a 1k resistor across the crystal terminals Y1 when the computer is sending the power-up message. The resistor stops the microprocessor oscillator and crashes the program. Within 8–15 seconds, the watchdog circuit U2 should restart the microprocessor and the power-up message should be sent. If using the voltmeter technique, the voltage on pin 10 should go back to 5 volts 6–8 seconds after the computer is reset.

Next month in Part II we will discuss the audio board and operation of the whole controller. ■

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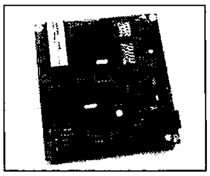

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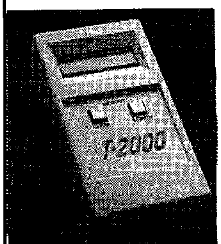

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73 Review *by Michael Geier KB1UM*

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To paraphrase an old song. . . look what they've done to my walkie, Mah. Wow, this new Kenwood dual-bander is a true technical marvel. Slightly bigger than the single-band TH-25AT, the new rig packs 2 meters and 440 in one handy package. OK, that's not big news anymore. But this rig has more features than I ever imagined could exist in one radio. That characteristic is both its strongest and weakest point.

First Impressions

The radio feels solid and well made. Unlike the TH-25, it has a nice, easy-to-operate PTT switch. All the buttons are on the front and one side, making them easy to find. The LCD is big and shows lots of stuff, including two S-meters, tons of status indicators, and both operating frequencies at once. As on most new rigs, the final zero is not displayed, and there is just a tiny digit for a final five. The display on this radio has a very low contrast. You must look at it from just the right angle to feel comfortable with it. The angle seems well chosen for normal handheld use but, in my overhead-lit room, at least, holding it at the "sweet spot" results in glare from the room light, making it hard to read the numbers. As on the new TH-27A, the display window is convex and presents the highest point on the face of the rig, making it a target for scratches.

The buttons are rubber or soft plastic, and although many are small, they are easy to push and widely spaced. The dual-band duck antenna is completely rigid plastic on the lower half, but flexible on the top half.

The power switch is a recessed rubber button on the side, above the PTT and MONITOR buttons. Being used to the traditional rotary switch on the volume control, I wasn't wild about this idea at first, but I have come to like it. The button is quite stiff, making it unlikely that it will be turned on by accident. Besides, you must hold it in for a significant fraction of a second or it won't work, further reducing the likelihood of accidental operation.

On top, there are dual concentric volume and squelch controls, one for each band. There's an oddity here, though: the main and subbands volume controls can be swapped depending on which band you are transmitting on, but the squelch controls stay fixed. It is easy to wind up with VHF volume and UHF squelch on one control, with the situation reversed on the other! It's not serious, but it can be confusing. Since squelch tends to be a set-and-forget operation, perhaps it would be better if the squelch controls were small, recessed knobs on the back of the radio. Overall, the rig feels like solid, professional gear in your hand. It has a nice, inviting quality to it—you just want to pick it up and talk into it.

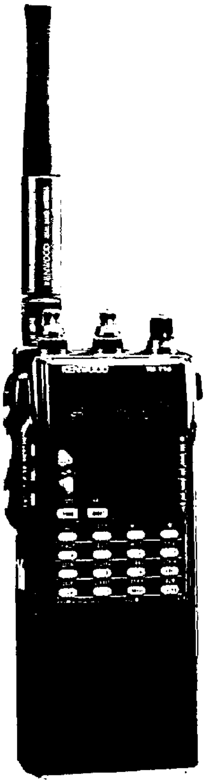

Photo. The TH-77A, Kenwood's compact dual-bander.

Pick a Feature, Any Feature

Let's see. . . we've got 42 memories, DTMF autodialing, simultaneous receive on VHF and UHF (or on two UHF frequencies at once!), CTCSS, DTMF paging and calling, Automatic Band Change, dual LCD S-meters, a direct DC power jack on top of the rig, the ability to route the two bands' receive audio to separate speakers, crossband duplex operation, and all the now-standard features like scanning, automatic and variable offsets, and so forth.

Unusual features include the above-mentioned ability to monitor two UHF frequencies at the same time. Note that I am not referring to "priority" watch operation (which the rig also has), but to actual full-time simultaneous receiving. Apparently, the second UHF frequency is monitored through the VHF front end, though, because the manual warns that in this mode the second frequency will exhibit reduced sensitivity. But what the heck, it still could be useful in a major metropolitan area like L.A., where UHF activity is extensive. The rig cannot simultaneously monitor two VHF frequencies; I guess the UHF front end can't be tricked into receiving VHF.

Other noteworthy features include the DTSS, or Dual Tone Squelch System. This system allows you to monitor a busy repeater without having to listen to the chatter, yet be called via a three-digit DTMF sequence. Also available is a paging function, which is somewhat similar to the DTSS but provides for both personal and group codes and also displays the calling station's ID code. There is a limitation to these features, which I'll discuss later on.

The LCD S-meter functions as a battery level meter on transmit (a nice touch), and the rig uses the batteries and most accessories from the TH-25 and '26 series. It includes a belt clip and two nifty covers. One slips on the bottom of the rig when you power it from the external DC jack on top and have no battery connected. This arrangement makes for very nice mobile operation, because all the cables exit from the same place and there is no exposed connector on the bottom. In this configuration, the entire radio is about the size of a microphone!

The other cover slips over the keyboard, protecting it from scrapes and damage. A flexible button is provided so that you can operate the FUNCTION key without removing the cover. By the way, the keyboard is backlit along with the LCD, and the lights can be locked on, making the rig much easier to use in the car at night. The lights are all LEDs (thank goodness, no more incandescent bulbs), so you don't have to feel guilty leaving them on for long periods. Naturally, you won't want to do this when using batteries, because the battery life will be significantly shortened.

Basics

As delivered, the radio receives from 136.000 to 173.995 MHz and 438.000 to 449.990 MHz, and transmits from 144.000 to 147.995 and 438.000 to 449.990. Interestingly, Kenwood's ads for the rig specify that it can receive 118–136 MHz AM (aircraft) after modification, but there's no mention of it in the manual.

MY GAP CHALLENGER DX-VI

Lew McCoy, W1ICP
CQ Technical Editor
(March 90 Review)

..."could actually hear signals that were in the noise on the beam. In my comparisons between the base-fed vertical and the GAP, the GAP consistently outperformed the base-fed antenna. Most of my reports were approximately one s-unit better with the GAP. One other surprise was that the GAP vertical was quieter (less noise) than the two base-fed verticals. I would rate the GAP as a quality product, but even more important a good performer."

Richard Morrow, K5CNF
73 Magazine
(October 90 Review)

"another very good thing about the GAP antenna is that you don't have to tune it. Usually broadband antennas are not very efficient, but this one is. If I could have only one antenna, I would definitely rather have this one. The lack of lossy coils, and the coverage of a very wide part of 75 meters by an all band vertical, impressed me more than a little!"

Kurt N. Sterba
Worldradio Magazine
(February 91 Review)

"These guys have solved a problem associated with verticals. That is, an awful lot of RF is wallowing around and dropping into the dirt instead of going outward bound. How does it perform? Like a hot knife through butter. I was just a barefoot boy answering the CQ callers. They just kept coming back to me. POW! POW! POW! I am almost struck with disbelief myself. I mean, this is a vertical. But then, it's a vertical with a big difference. I was indeed pleased. If I were a whole lot younger and I had two of those GAPs phased, I'd tell those contest hotshots to . . . look out!"

CIRCLE 172 ON READER SERVICE CARD

There is a mod which will enable aircraft RX, crossband repeat, and even reception of some other non-ham bands. Naturally, you're not supposed to do it, but also naturally, the procedure is already floating around. When will they ever learn that we hams don't like secrets kept from us in our expensive purchases? If they didn't want us to do the mod, they either should have made the advertised aircraft band RX a standard feature or not advertised the capability in the first place.

As on most of the new miniaturized walkies, the speaker is small and somewhat tinny, and there's not a great deal of audio output. It's not bad at home, but it can be hard to hear the rig in a noisy car or pickup truck. I can't fault Kenwood here; that's just as good as it seems to get from a speaker that small. The transmit audio is crisp and clean, as is usual in Kenwood rigs. The mike is somewhere inside the speaker cutout, but I can't see it on this radio. It doesn't matter; if I talk at the speaker hole, it transmits fine.

Receiver sensitivity seems good, even outside the ham bands. The included dual-band duck antenna is something of a compromise, especially on VHF, but the result is certainly adequate. Even so, the NOAA weather station on 162.400 MHz comes in better than it does on my other HT with a single-band antenna. The selectivity is typical of Kenwood rigs, being OK but not real sharp. It can be hard to tell when you're 5 kHz off.

Renaissance Radio

I love high-tech toys and, up until now, I've always felt that the more features, the better. But this rig may finally have gone too far. No question about it, it does everything and then some. In fact, it has features I've never even thought of, some of which are slick and useful, and others which seem pointless to me. Let's look at a few:

You can select which band will be heard when you press the MONITOR button to open the squelch. There are three options: main, sub or both. You can change the sequence of some of the keys, such as the CALL/C SCAN key, so that they perform different functions in different orders. You can select CTCSS independently on each band. In addition to the usual VFO scan limits, you can set VFO tuning limits which will prevent you from tuning the VFO outside them. (Since you are already protected from *transmitting* out of band, I can't imagine why you'd want to do this.) You can select whether or not you want the rig to stay keyed while you manually send DTMF, even if you let go of the PTT. There's even a choice between two beeper sounds for the tone alert function. You can reset the VFO and memories independently to default condition. You can swap the main and subbands, and also select full-duplex crossband operation, listening to one band while you talk on the other! Using this feature, it is even possible to converse telephone-style, continuously transmitting while listening. (You'd better have a big battery and wear gloves, though, because continuous transmitting will drain it fast, and the rig will get quite hot.) You can select from eight scanning modes. And on and on... there seems to be no limit to the hoops you can make this thing jump through.

Strike Up the Bands

Managing two bands at once makes for some interesting control requirements and possibilities. For instance, memory management can be handled in several ways:

You can select a memory between zero and nine with one key press and then rotate the tuning control to get at the other 30. Or, you can split them into VHF and UHF. Or, you can select any memory with two key presses. Finally, there's "page recall," in which you can have it search through four banks of 10 memories each, looking for any memory with the same digit you entered, as long as it's on the same band. So, if you press "4," it will find memory 24 if it is on your selected main band. (If it sounds complicated here, believe me, it is even worse in the manual. But more about that later.)

Tidbits

I noticed several interesting operating characteristics, some of which I couldn't find in the manual. For instance, the output power level setting (HIGH, MEDIUM or LOW) follows the band. Thus, if you set the rig to LOW while transmitting on VHF, and then swap the bands, the output indicator will revert to whatever it was on the other band, and will come back to LOW when you swap back to your original band. It's a nice touch. Too bad the indicator, which is only active for the main band, is shown under the subband's frequency on the display, making it confusing.

The scan speed is medium, being quite a bit faster than that on older rigs, but nowhere near as fast as some other HTs. Also, as on most rigs, the scan stops when the squelch opens, which generally is not on the center frequency of the transmitting station. This, combined with the rig's only fair selectivity, causes the scan to stop three times on each station, with only the second time being on the right frequency. (It also makes the carrier-operated scan stop mode useless for VFO scan, because it will freeze on the wrong frequency and sound distorted.) It is a simple matter to examine the output of the FM detector for DC bias and stop only when it is zeroed in on the right frequency. I wonder why nobody does it; it would be a great improvement.

The S/battery meter displays have 10 steps each but, like the TH-25, they always move in groups of two, so they are really five-step displays.

The radio can be used as a crossband repeater, but not without the modification. Crossband repeat is something people actually use now and then; I wonder why they didn't make it standard.

The battery saver and automatic power off modes can be turned on and off but not adjusted for their time periods. The APO operates after 59 minutes, and there is no mention of the duty cycle of the battery saver. In general, it works well and you should only want to turn it off for packet, DTSS or paging operation.

The tone alert starts a timer which shows

you how long it has been since the call was received.

Making the Complex. . .Complex

The problem is, the presentation of all these wonderful features is truly intimidating. I fully realize that having so much to offer results in some hard choices regarding key press sequences and such, but the interface as well as the key labeling is confusing. For instance, there are the AL, S.CT, M.CT, S.DT, M.DT, C.SEL, U.CHG and UXU keys. Do you really expect to remember what any one of them does? Better mnemonics could have been helped. And the display shows ABC, DUP, DT, CT, TX.S, L, M, R, AL, C, another M and others.

There are various combinations of key presses which seem to make no sense. For instance, to change memory banks, you press the LAMP button along with a digit. Why the LAMP button? And you press the M key and then the MONITOR button (which normally opens the squelch) to enter phone numbers into the DTMF memories. The SCAN key lets you set codes in paging mode. And so on. I know I can't remember sequences such as these, because they have no discernable patterns.

Some rigs have default settings which you select by holding a key while you turn the power on. This rig has *twenty* of them! Most of them are things you won't want to change very often, if at all, but a few can get you into trouble if you forget what they do. And, while some have an indication on the display, some don't. For instance, you can change the delay time before the dual-tone squelch system sends its tones by holding the MHz key and turning the power on. Doing the operation twice causes two different beep tone sequences to sound as the extra delay apparently turns on and off. But nothing shows on the display, so I have no idea what is actually happening, and the manual gives no hint either, because the meaning of the two tones is never discussed.

By the Book

And that brings us to the documentation. Yes, it is fairly complete but, like so many of these booklets, it is written in Jenglish and contains such gems as "use of earphone causes no howling" ("to avoid howling, use an earphone"); and my favorite, "During A.B.C. operation, being exchanging the bands each other" (??? no idea). There are plenty more of these. It's hard enough trying to learn a complicated rig without struggling to decipher incomprehensible language.

I don't mean to suggest that you can't learn to use the rig from this manual; you can. But it is dense reading and will take awhile. To its credit, Kenwood has included a full set of schematics. But the microphone hookup diagram on page 8 of the manual shows a wire with an arrow going nowhere. If you're a technical type, you can probably figure this out from the rest of the diagram. If not, good luck.

A rig this complex and difficult to use needs a wallet-sized "cheat sheet" card. Most new rigs include them, but this one does not.

Tough as this rig is, there is a way you can enjoy it without killing yourself. All you have to do is preset most of the functions once and then memorize only the subset of commands you will use on a daily basis. Apparently, this is what many hams are doing. Here is a report from Greg N4PSA in Miami, who has owned his TH-77A for several months:

"Having purchased the TH-77A in January makes me the local Elmer, so I have been helping folks out with their questions. One overriding complaint from the '77 crowd is about the manual. Actually, all of the functions and features are described, but not clearly.

"During the requisite learning stage of '77 ownership, I saw that the paging function would not work through most of the local repeaters, since they mask transmitted DTMF tones for security purposes. Although some repeaters will pass the tones, they usually must be preceded by sequences which include the # or * to disable the masking function. Unfortunately, the TH-77A does not allow those codes to be sent; it permits only the digits 0–9. This limitation makes the paging feature inoperable in most big cities, where it would be most useful.

"After familiarizing myself with the rig and all of its capabilities, I found that I really only used a small portion of the features. In the end, I left most of the options set up at the factory defaults. It sure would be nice to have a wallet-sized function guide card. I do like the rig, though. It's small, it's light, and when you need to make changes, the flexibility to do so is there. . . but don't lose the manual!" 73 de N4PSA

Get the Bug Spray

Any radio this new and advanced is bound to have a few bugs, and the TH-77A is no exception. Here are some I've found, or heard about and verified:

Kenwood's ads show the upper VHF frequency limit as 165 MHz. Although the radio actually tunes nearly to 174 MHz, the frequency synthesizer won't lock reliably above about 168 MHz. You can tell when it's out of lock because the rig beeps about once per second. The first time it did that, I had no idea what it meant, because it isn't mentioned in the manual.

Several people have reported problems with losing all the memories if they let the battery get low enough to cause the display to flash. Apparently, once it starts flashing, the rig refuses to respond to the power switch, so you can't shut it off. Eventually, the memories get trashed. Naturally, there is an internal lithium battery which is supposed to prevent this sort of thing, but something goes wrong and it doesn't kick in under these circumstances. Greg advises that the cure is simple: If the display flashes and you don't have other power available, remove the antenna (so you won't receive anything) and battery pack, and let the pack sit for about 20 seconds. Then put the battery back on. It should have recovered enough to let you turn the rig off.

There's an option which lets you send either band out to an external speaker while listening to the other band on the internal one. If you select this option but don't plug a speaker or

Continued on page 47

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CIRCLE 172 ON READER SERVICE CARD

Low-Pass Antenna Tuner

Match your antenna while reducing harmonics with this unique design.

by J. Frank Brumbaugh KB4ZGC

Most commercial and home-brew antenna tuners use essentially the same T-circuit—two variable capacitors in series with the RF, and a tapped or rotary inductor from the junction of both capacitors to ground. Obviously, this circuit works well. It can transform a wide range of impedances to match the nominal 50 ohm output of modern solid-state transceivers over a broad frequency range, from 160 or 80 meters through 10 meters.

However, it also has some disadvantages. It is a high-pass filter configuration and does nothing to reduce the amount of harmonic energy reaching the antenna. Construction is somewhat complicated in that both capacitors must be insulated from the cabinet. Under some impedance matching conditions, the set screws in the control knobs can "bite" your fingers with RF. Also, the cost of high quality variable capacitors and the difficulty of finding them today is discouraging.

There is a simple way of eliminating all these disadvantages while retaining the wide frequency range and impedance matching ability. This circuit is not new—it has been used by a few hams for years—but for some reason it has not received the publicity in ham literature that it deserves.

The Circuit

See Figure 1. This low-pass antenna tuner schematic retains a simple T-configuration. Now, however, the circuit forms a low-pass filter that reduces harmonic energy falling in the television channels by up to 20 dB. Only one variable capacitor is used, and its rotor is grounded, eliminating the possibility of RF biting one's fingers. A center-tapped inductor is in series with the RF, and the center tap is connected to the stator of the shunt-tuning capacitor. Both sections of the series coil are tapped every two turns, and the taps are selected by a pair of rotary wafer switches mounted directly to the grounded panel.

Theory of Operation

Selecting various coil taps with the rotary switches and varying the setting of the variable capacitor, much in the same way the standard tuner is adjusted, changes the operating frequency and impedance transformation ratio. This makes it possible to tune out any reactance, bringing the SWR down to 1:1, keeping the transceiver—and its owner—happy.

Because one tap point on each switch is connected to the center tap of the inductor, it is possible to change the circuit from a T- to an L-circuit with a choice of inductive or capacitive input. This lets you use the tuner with low or high impedance end-fed antennas, including random wires. This feature, impossible to achieve with the standard T-circuit, is handy for Field Day, and could be invaluable in emergency operation with a makeshift antenna.

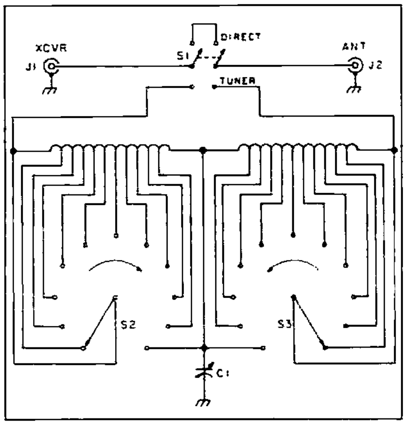

Figure 1. Schematic for the low-pass antenna tuner.

Construction

A shielded metal box or an enclosure made of printed circuit board material should be used. However, this tuner will function equally well "in the open" on a breadboard. Because this unit is designed for the 3–30 MHz range, lead lengths are relatively unimportant.

A single length of air-wound inductor (Barker & Williamson or Airdux) with a total inductance of 35 to 40 µH, or a pair of tapped toroids (T106-2 or equivalent) will work equally well in this circuit. Both coil stock or toroid cores should be chosen with the power level of your rig in mind, of course. I use a Kenwood TS-440S "barefoot," so I chose a "50 watt, 80 meter" plug-in coil of the 5-pin type common in the 1940s and 1950s, which I found at a hamfest for 50¢. It has an inductance of about 17 µH each side of the center tap—34 µH total. It is tapped every two turns.

The shunt-tuning capacitor should have a plate spacing of at least 0.05" for use with the usual 100 watt transceiver. The two wafer switches are ceramic, single pole, 11-position, with shorting contacts. I used a surplus 140 pF tuning capacitor from a BC-610 tuning unit, another hamfest prize purchase. However, a 100 pF capacitor should be sufficient.

The parts layout can be whatever the builder prefers, though the logical arrangement is to mount the wafer switches in a horizontal line on the panel, with the capacitor mounted between them, or slightly above or below the wafer switches.

A miniature DPDT toggle switch, rated 6 amperes at 120 VAC, is included for ease in inserting or bypassing the tuner in the transmission line. This is not required, but it eliminates unscrewing and rescrewing a lot of coaxial jumper cables when changing from using the tuner to feeding the transmission line directly.

Finding the Parts

Check out your junk box. Ask local hams and at your next ham club meeting. Scrounge the flea markets at hamfests. These are the cheapest ways of getting the coil and capacitor.

If all else fails, suitable air-wound inductors are available from *Surplus Sales of Nebraska, 1315 Jones, Omaha NE 68102.* Suitable variable capacitors are available from *Fair Radio Sales, P.O. Box 1105, Lima OH 45802.* Radio Shack and numerous mail order electronic parts dealers can supply a metal enclosure, knobs, wafer switches and RF connectors. *Radiokit, P.O. Box 973, Pelham NH 03076 (603) 635-2235* is another good source of wafer switches, coils (B & W Airdux series) and large variable capacitors. The capacitor plate spacing and the size of the coil will depend on the amount of power you wish to run through the tuner. For example: If you are running under 100 watts try using Radiokit coil # 1606T or 1608T (2" diameter B & W Airdux) and variable capacitor #21140 (Millen) or #149-6-1 (Cardwell).

Parts List

C1	100 to 150 pF variable capacitor, 0.05" spacing.
J1, J2	SO-239 or other RF connector.
L1	35-40 µH coil, center-tapped.
S1	DPDT toggle switch.
S2, S3	Single pole, 11-position ceramic wafer switch, shorting contacts.

Operation

Connect the low-pass antenna tuner between the antenna transmission line and an SWR meter which is connected to the output of your transceiver. Set C1 to half

Continued on page 73

Continued from page 45

earphone in, the "external" band does not revert back to the internal speaker. It just disappears! The rig was set to this mode when I got it and I thought one band was broken. It took me quite awhile to unravel the mystery.

Suggestions

The SHIFT/REVERSE button should have its functions exchanged, so that reverse could be selected with one key press. You don't change the shifts all that often anyway, so it would be fine for them to require use of the FUNCTION key.

I doubt the "one-upmanship" trend of cramming more and more digital features into walkies is going to go away, but they can be made easier to use. A rig this versatile could use a better display system.

The next logical step is a dot-matrix, scrollable menu display like those found on pocket computers. That, along with a better-organized control sequence, would go a long way toward making a nifty radio like this one a joy to operate. At the very least, a "set" mode, in which all the rarely-changed default settings are grouped, would be useful.

Conclusion

All in all, this is the slickest dual-bander I have yet used. It feels good, works well, and has more features than I will ever need. This is a premium rig for those desiring the utmost in versatility. If you're in the market for a dual-bander, check it out. With an improved user interface, it could be close to ideal for everybody. ■

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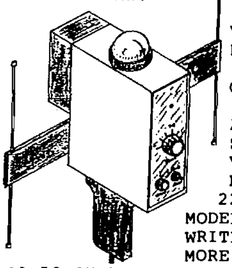

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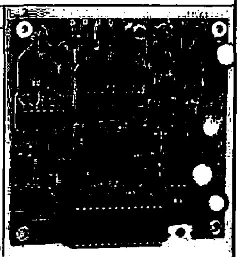

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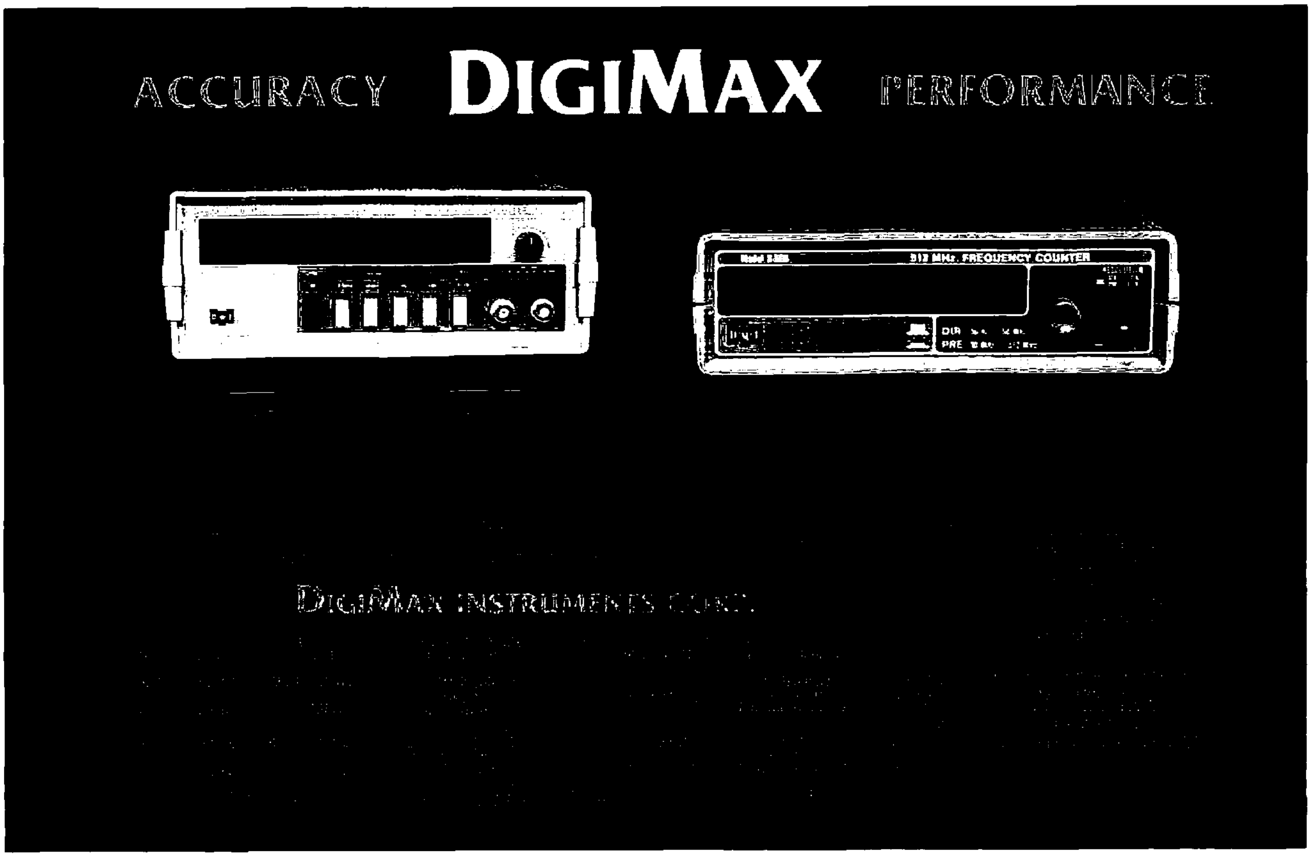

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Sacred Heart Amateur Radio Club

In April 1991, I had the pleasure of meeting in person with Dave Novak NØDN at the Dayton Hamvention. He and his students had checked into the CO All Schools Net several times, and we had exchanged interesting tapes, pictures, and letters between our two groups. Our meeting at the Hamvention convinced me that the work of Dave and his amateur radio club students could serve as a wonderful inspiration to other instructors. The following is Dave's write-up about how he organized this exciting program for young people.

De Dave Novak NØDN

I have been licensed since I was in 7th grade. My primary mentor was my dad, Joe Novak WØPGI. As a teacher and youth minister, I began working with junior high students about 14 years ago. My work with them in technical areas began when I was at a school that had a variety show for students, parents, and friends. I began training students in taking still photos, taping videos, and operating sound and lighting equipment. At the next school, I formed a club called the "Media Club," which got the youth involved in computers as well as photography.

Being a "teenage" (ordained 13 years ago!) diocesan priest, I get moved around every few years by the bishop, and I've formed clubs at each school. However, I never did try to interest kids in amateur radio. I believed up until recently that it would be too hard for junior high kids to learn Morse code, and that it would be too expensive a hobby for the general public. I thought to myself: "It is different if a parent is a ham and one of the children get interested, but 'normal' parents just wouldn't understand!"

To be quite honest, my own interest in the hobby had begun to wane. Although at every new assignment I did manage to get antennas up, I often went for weeks without getting on the air. Months would go by without my going to any ham club meetings or hamfests.

With the Help of an Earthquake

Then while at the rectory on the night of the big earthquake in the Bay area, my phone began to ring. Three people called and asked if I could find out about their loved ones. To my surprise, after only a couple of hours on the air I was able to find out that all three parties were alive and well. Perhaps for the first time in my long amateur career (30 years this fall!), I began to realize what a vital service our hobby can provide. I think that night was a turning point for me. Shortly after that, I began getting on the air more frequently and going to ham club meetings, breakfasts, and hamfests.

Soon after that, I was moved to my present QTH. Since it was in the middle of winter, I only put up a temporary antenna. Then in the spring, I put up the tower.

While the maintenance man, Ed Gilmore, helped me level the newly poured cement for the tower, some students passed by and wanted to put their initials in the wet cement. I encouraged them! Over 100 kids wrote their initials, a couple made hand prints, and one girl made an impression of her foot.

The next week I set up a station in one of the classrooms, and arranged for each class (grades 5 through 8) to come in for a demonstration. I printed up a flyer with photos of myself as a young ham. The flyer stated that there would be a "ham radio camp" during the summer. No 8th graders signed up. No 7th graders signed up. No 6th graders, either! Only one 5th grade boy and two 5th grade girls expressed an interest.

At first I was quite disappointed. But I thought: "I didn't get my license till I was in the 7th grade, even with my dad being a ham. How can these 5th graders possibly get their licenses? What the heck—I'll give it a try!"

Photo A. KBØHWN checking into the All Schools Net during her lunch period.

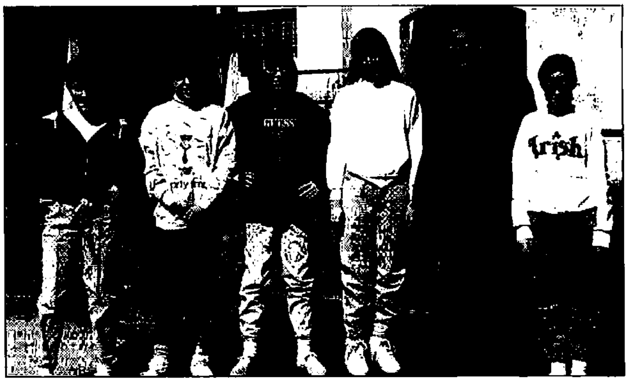

Photo B. (Left to right:) Jenny Ebert KBØIYT, Vanessa Gomez KBØIXY, Amy Rosa KBØIRI, Angie Fischer KBØHXY, Dave Novak NØDN, and Mary Ellen Federhofer KBØHWN.

I began by getting them *Tune in the World* kits, and encouraged them to listen to the code tapes. When the camp actually began in July, two more boys showed up. I solicited the help of a ham friend of mine who was free during the day, and also the help of two teenage hams. We met Monday, Wednesday, and Friday from 9 a.m. till noon for two weeks. During this time we studied rules and theory, practiced code, and built code oscillators. Also, one morning we took a "field trip" to visit another local ham. By the end of camp, 4 out of 5 students passed the written test, but none were able to copy the 5 wpm code.

More Students Join the Club

In September, to my surprise, the kids wanted to meet weekly, and some of their friends wanted to join. This presented a challenge, since the original group was so close to getting their Novice while the rest had only good intentions! Then I discovered a retired telephone company engineer, Steve Gies WØKOC, and was able at times to break the group up into two. Also, I found the young almost-hams willing to help their friends out.

Because 5 wpm seems so difficult for someone just learning code, we worked out a special incentive program. There were special prizes for just being able to recognize the alphabet, for receiving at 3 wpm, and for receiving at 4 wpm. Since many of the prizes had something to do with the local ice cream parlor down the street, it became a regular routine of our Wednesday after-school gatherings.

In October, we received a 10 meter transceiver from Uniden, which we set up in the classroom but also allowed kids to borrow and take home after school. I kept the microphone at school so there would not be any temptations too great to resist!

By Christmas, each of the five original members received their Novice licenses: Mary Ellen Federhofer KBØHWN, Angie Fischer KBØHXY, Tom Winkler KBØIBA, Matt Kirchhoff KBØICV, and Patrick Scheu KBØIDH. In fact, Angie received her license on Christmas Eve, and came to church service about an hour early so she could make her first contact. The next day, she had an antenna up in her own back yard. Mary Ellen had received her license just a week or so before, and was also on the air with borrowed equipment.

My original idea was to rely mainly on the school station for the kids to operate. But once I saw the thrill of the kids having a station set up in their own home, I began to look for ways to acquire additional equipment.

Although I knew that we could raise money quickly by selling chocolate bars, I wanted to do something that would bring the group together, and allow the children to use their talents and creativity. The idea of a "dinner theater" came to mind. I knew that some of the girls had already written a skit about dating. I suggested that they write their own rap about ham radio and call themselves "The Code Girls." To my surprise they accomplished this in a few days.

There were some difficult afternoons shortly before the big night when things did not go well! It was only a week away, and some of the kids did not yet remember all of their lines. But somehow when the big day came, the kids did great and everyone had a great time. One of the mothers, Shellie Kirchhoff, was able to fix pasta and salad for over 150 people for only $140! Even though we charged only $5 per person, we ended up making over $700, which included donations from folks who could not come, but sent in $5 or $10 to help out the kids.

Most of the money I had already spent, having just come back from Florida with a station wagon full of radio gear that I had bargained for in Memphis and Indiana as well as Florida. We have about five used radios we have purchased—the best being a Drake TR-3 which we paid only $150 for, and which performed well just as we received it. Some of the other gear that's not working is being restored by Cathy Barne's dad, Wayne Barnes, who repaired radios when he was in the Service.

More Accomplishments

Since the dinner theater, several others have passed their Novice exams: Julie Thien KBØIRH, Amy Rosa KBØIRI, Sean Sitek, Vanessa Gomez,

Photo C. Patrick Scheu KB0IDH (left) and Tom Winkler KB0IBA (right) on low band "ground wave" operation.

Jenny Petersmeyer, and Jenny Ebert. I feel confident that three other members will soon pass their Novice exams: Mark Moore, Cathy Barnes, and Jason Roskowski. The same day Sammy AA0CR received the Westlink Young Ham of the Year Award, we had our first upgrade: Angie Fischer, who passed the Technician exam.

Yesterday I fixed lunch for some of my adult local ham friends, and also arranged for some of our new school hams to join us. After dinner, they performed "Morse Code Baby" then introduced a spontaneous routine. Once they perfect this, we'll make a video of it! (Watch out, East Coast and West Coast! The Code Girls will soon be taking over the U.S.A. by storm and invading everywhere! No classroom within the continental U.S. and maybe beyond will be safe any more entrenched in a pre-technical subculture deprived of their right to the exciting new world of ham radio!)

This week, we are working on plans for a new "Summer Ham Camp" especially for junior high kids. I am meeting with Sammy AA0CR, who has volunteered to help. Most likely we are going to try to acquire a central location where young hams from all over the metro area will be able to participate. We have a lot of work ahead of us, but with almost unlimited enthusiasm and spirit to drive us on! 73

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences along with photos, to Carole Perry at the above address.

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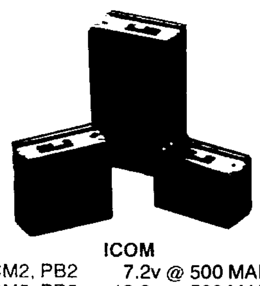

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CIRCLE 191 ON READER SERVICE CARD

73 Review

by Bill Clarke WA4BLC

The Drake R8 Receiver

R.L. Drake Company
540 Richard Street
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Price Class: $979.
Tel. (513) 866-2421.

Tune in the world with this hot new receiver.

A Drake, a real Drake! The folks from Miamisburg have finally produced a new product for the radio hobby market—a high grade communications receiver aimed at the lucrative and popular SWL market.

Before I started this review I looked back into radio history and found that from about 1979, the Drake R7 communications receiver was the last available Drake HF receiver. The last piece of HF ham equipment from Miamisburg was the TR7 from 1978, from which the R7 got its general appearance and features.

Prior to the R7, Drake communications receivers included the DSR1 (1971) and the DSR2 (1974). One of their most popular receivers was the SPR-4 from the early 1970s. All solid state and featuring a linear PTO and vernier dial providing 1 kHz readout. So much for history; let's look at this new release from Drake.

Appearance

The R8 has a very functional, businesslike look, sporting few manual controls, and a black finish. The lack of radio-like appearance is due to the heavy reliance on state-of-the-art digital control. There are only six standard analog controls on the unit, as nearly every possible selection that can be made by switching is accomplished via the dual-purpose keypad or a function switch.

First Impressions

The most apparent feature of the R8 is the very complete LCD display. Measuring 5.5" x 1.5", it displays all functions and settings in bright characters on a black background, making status checking super easy.

The layout of the function buttons places them directly beneath their corresponding readout points, making selections of AGC, bandwidth, mode, etc., very easy to use as well.

Frequency control is via direct entry on the keypad, with the UP/DOWN buttons (in 100 kHz steps), or a TUNING knob (with a choice of tuning speeds). The frequency reads out to 10 Hz (user selection). When put on a frequency, the rig can be locked and it will remain there indefinitely. It's very stable. There are two VFOs which you can select instantly via function switch, and 100 nonvolatile memories. This means no batteries are required for memory backup; power interruptions will not erase the memory.

Scan features allow scanning of all memories, selected memories, or the frequencies between the settings of VFO-A and VFO-B. The SQUELCH control greatly enhances the use of SCAN, and is active in all modes.

Bandwidth from 6 kHz to 500 Hz can be selected in all modes. This is a very good feature for crowded band conditions, and for fidelity during better times. After all, AM does sound better at 6 kHz wide than at 1.8 kHz. But each bandwidth has its place and use.

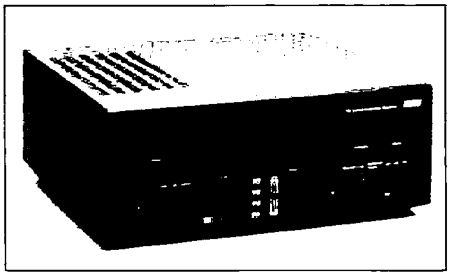

Photo A. R.L. Drake's new R8 receiver for SWLing.

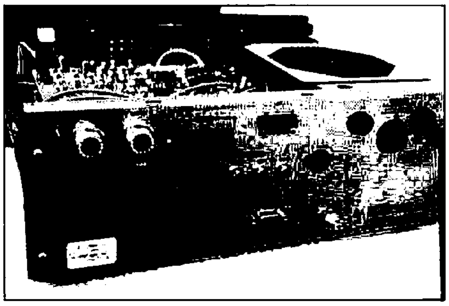

Photo B. The R8 can be connected to various antennas as well as to a computer through the RS-232 port.

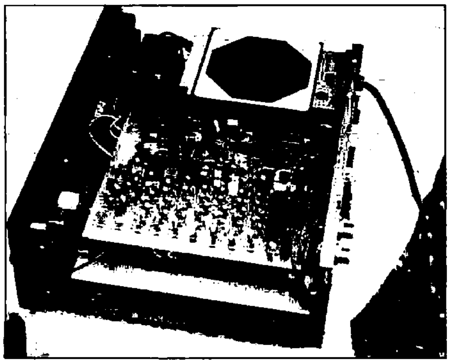

Photo C. This inside view of the R8 reveals just how neat and sturdy it is!

The controllable AGC, NOTCH FILTER (manually operated from an analog control), NOISE BLANKER, and RF input controls (analog and switched attenuator/preamp) all combine to make the receiver very flexible.

Unlike ham equipment, the R8 has a built-in clock/timer with an output port on the rear for remote control of a tape recorder (or other hardware). This time feature is very popular with SWLs for recording odd-hour programs, and it can also be used in a clock-alarm-radio scheme (though a very expensive clock-radio). The clock also displays time on the LCD when the unit is powered off.

The fold-down front feet make table placement and viewing of the LCD display and S-meter clear and easy.

In many ways, the R8's control and display system is not far from that of a modern, full-featured 2 meter HT. Loads of bells and whistles provide extensive flexibility.

The manual that comes with the R8 is very well done, with complete explanations about each feature and control. A section is included that delves well into computer command of the digital switching system, and a log is included to write down the pertinent information about what is entered in each of those one hundred memories. It is, however, without block and schematic diagrams.

Operating the R8

The R8 was tested on a 160 meter Carolina Windom antenna (about 265 feet long) at 50 feet, and also on a 40/75 meter dipole at 35 feet. It was compared, via an A/B switch system, with an ICOM R71A. I selected the R71A due to its excellent reputation as a "world SWL standard."

The tunability and stability of the R8 are excellent; however, although the tuning knob has a good weight, it's a little small for my taste.

I am a real believer in keypad frequency entry. It is quick and accurate. The rubberized keypad is easy and flawless to operate.

When in the AM mode, I found the SYNCHRO (synchronous detector) to be great when fade-caused distortion became a problem. This is a feature that really works.

	Specifications
Frequency Range	0.1–30 MHz
Modes	AM, LSB, USB, CW, RTTY, FM
Sensitivity	SSB & CW (10 dB S+N/N)
	<1 µV (0.1–1.5 MHz)
	<0.5 µV (1.5–30 MHz)
	<0.25 µV (5.0–30 MHz) preamp on
	AM (10 dB S+N/N)
	<3 µV (0.1–1.5 MHz)
	<1.5 µV (1.5–30 MHz)
	<.8 µV (5.0–30 MHz) preamp on
	FM (12 dB SINAD)
	<.5 µV (1.5–30 MHz)
Frequency Stability	< ±10 ppm (-10°–50°C)
Frequency Accuracy	< ±100 Hz (-10°–50 °C)
Selectivity	AM, LSB, USB, RTTY, CW
	6 kHz @ -6 dB–<12 kHz @ -60 dB
	4 kHz @ -6 dB–<8 kHz @ -60 dB
	2.3 kHz @ -6 dB–<4.5 kHz @ -60 dB
	1.8 kHz @ -6 dB–<3.6 kHz @ -60 dB
	500 Hz @ -6 dB - 1.5 kHz @ -60 dB
	FM
	12 kHz @ -6 dB - <25 kHz @ -60 dB
Ultimate Selectivity	>95 dB
Image Rejection	>60 dB (100 kHz–1.5 MHz
	>80 dB (1.5–30 MHz)
IF Rejection	>80 dB (45 MHz)
	>100 dB (50 kHz)
Dynamic Range	>90 dB (1.5 - 30 MHz @ 20 kHz spacing)
3rd Order Intercept Point	> +5 dBm @ 20 kHz spacing
	>-20 dBm @ 5 kHz spacing
IFs	First 45 MHz;
	Second 50 kHz
AGC	Attack time 1 ms
	Release 2 sec (SLOW)–300 ms (FAST)
Antenna Input	50/500 ohms
Notch Filter	Audio Type >40 dB depth (500–5000 Hz)
Audio Output	2.5W @4 ohms with <10% distortion
Recorder Output	300 mV @4.7k ohms
Demod Output	300 mV @ 4.7k ohms
Clock Accuracy	< ±2 sec/month
Power Requirements	100/120/200/240 VAC (60 Hz) @40W
	11–16 VDC @2 amps
Size	13.1"W x 5.2"D x 13"D
Weight	13 lbs.
Accessories	•VHF converter 35–55 and 108–174 MHz
	•Matching external speaker
	•Software package for the IBM XT/AT (clones) to allow enhanced operation of the R8

The NOTCH filter, although effective, was disappointing in depth and in its analog operation. I cannot understand why any manufacturers produce receivers with manually operated notch controls today. My Datong ANF (Automatic Notch Control) knocked out tones the R8 could not—and with no manual control input!

The PASSBAND OFFSET was, as expected, effective in removing interference from nearby signals. Selecting a narrow bandwidth made it all the more effective.

I was not impressed by the internal speaker with its typically poor fidelity. An external speaker is a must for real enjoyment.

The S-meter read as expected, and compared in accuracy to other receivers.

The tone control lacks real BASS/TREBLE authority.

The R8 is a natural for computer control, since all controls, except for those in analog form, can be commanded via the RS-232 port. Command information about computer interfacing is given in the manual (this section is very good). Suggested software for computer control includes PROCOMM PLUS™ and BITCOMM™ operated on an IBM XT/AT or clone. Optional software is available from Drake for use with the R8 (not available for this evaluation).

On a warm summer evening when the popcorn (static caused by distant thunderstorms) was popping heavily, I listened to my regular nets with the R8. The R8 held its own very well, being less affected by the static than my ICOM IC-751A transceiver. It was not as quiet as the Ten-Tec Corsair II, but then, these pieces of equipment are of a very different design and purpose.

The choice of bandwidth made it fairly easy to reduce nearby signals, such as those that abound on 75 and 40 meters. Add the passband filtering, and you can just about eliminate any adjacent signals as much as is possible.

Speaking of bandwidth, you should hear what a real strong LSB signal on 75 sounds like through the 6 kHz filter. Just like broadcast AM! Too bad I couldn't locate the mike plug on the R8.

A Few Comments

After carefully evaluating the Drake R8 receiver, I must say that I am well pleased with its performance. Over the years more than a few pieces of Drake equipment have passed through my shack, and I still think you have to go a very long way to beat the receivers of the R4 series. They were quiet, stable, selective, and sensitive. The R8 compares favorably with these older receivers, as few digital-type receivers can.

Modern digitally-controlled receivers make lots of internally manufactured noise—noise that adversely affects their operation. The Drake R8 does not suffer appreciably from this problem.

The R8 is like a breath of fresh air, with its ground-up engineering and up-to-date digital control from the front panel. I am very pleased to see a quality HF receiver of American manufacture that should successfully compete on the world market.

Oh yes, a public question for Drake: Where is the T8 transmitter to go with the R8? The world is waiting! 73

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Build the TBOX

At last, you won your club's competitive RDF contest ("foxhunt" or "T-hunt"). Now it's your turn to hide the transmitter. You've driven for hours to pick the perfect hard-to-find spot, but now you need some distinctive audio to transmit, and a way to ID the hidden "T."

You could stay with your rig and talk throughout the hunt. But that's hard on your throat and gets boring after a while. Besides, if hunters spot you, they'll know where the "T" is. It's lots more fun to conceal the fox, perhaps even bury it! Then you can stay under cover nearby and watch the fun as the hunters approach and try to "sniff" it out.

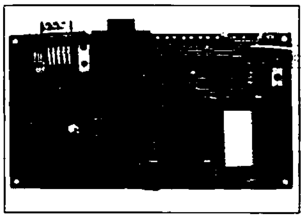

Photo A. Prototype TBOX circuit on N6MBR's PC board.

What you need is a "tone box" or "foxbox." A good one produces a distinctive sound, so the hunters have no doubt that they're tracking down the right signal. It cycles the transmitter on and off periodically for intermittent-signal hunts.

A foxbox must incorporate station identification, to comply with FCC rules. The callsign should be easily changeable, to accommodate upgrades and permit the box to be used by all members of a hunting group. Small size and low battery drain are important design objectives.

Micro-P Solution

Several good discrete-logic circuits for tone boxes have circulated among T-hunters over the years. But for the utmost versatility, a microprocessor is ideal.

Ron Seese N6MBR is an active T-hunter with the Conejo Valley Amateur Radio Club, based in Thousand Oaks, California. He is also a clever digital designer and has developed a multi-featured foxbox designed around the 80C31 CMOS microprocessor. He calls it TBOX—a box to control the hidden T. It meets all the above requirements, yet it contains only six ICs and a few discrete components.

TBOX provides a readily-identifiable tone pattern for the hidden transmitter audio. Or, if you prefer, it sends randomly-pitched beeps. Transmission can be continuous, with regular CW identification.

For intermittent-signal hunts, it automatically turns the transmitter on and off at regular intervals, with CW ID on each transmission. You can select on and off times over a wide range. To save your batteries, TBOX draws only 60 mA at 12 VDC.

TBOX programming does not require a myriad of switch settings. In fact, there is only one switch on the unit—the power switch! To set the TBOX parameters (such as mode, callsign, CW speed, and on/off timing), just hook the RS-232 cable to your computer, load your modem program, and use TBOX's programmed-in menu structure. It's much like setting the parameters on your packet TNC.

A battery-operated computer with RS-232 port is perfect for programming your TBOX. If you don't have one, it doesn't matter. You can program it with your home computer (my old Kaypro works just fine) or even a dumb terminal.

TBOX includes a non-volatile memory (EEPROM) that remembers your hunt parameters. After programming, disconnect TBOX and take it to the hiding spot. When you turn it on in the field, it will come up just as you programmed it.

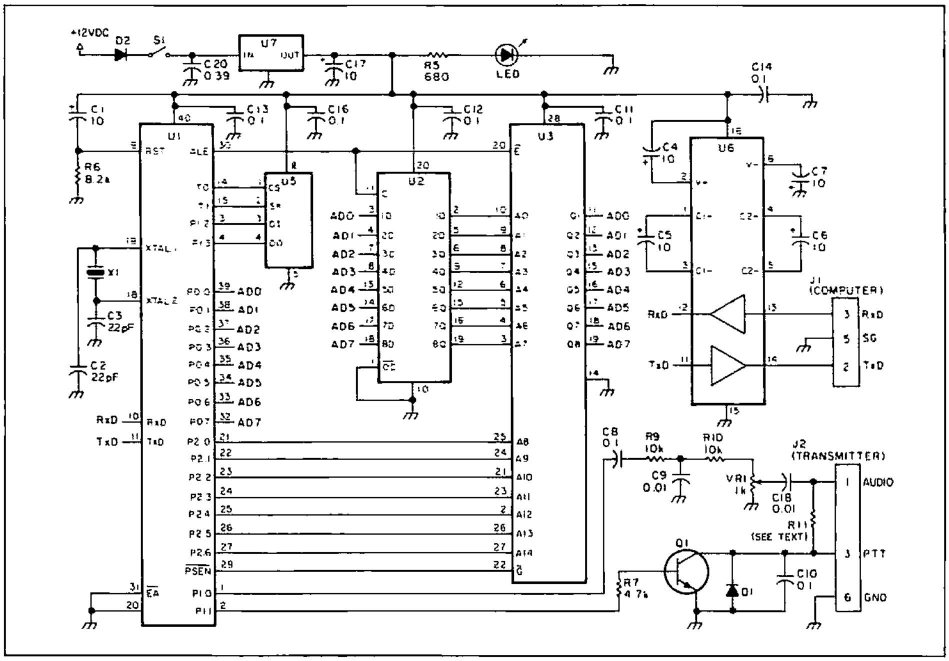

Figure 1. TBOX schematic diagram. All capacitances are in microfarads, except C2 and C3.

How It Works

Figure 1 is the complete TBOX schematic diagram. CPU chip U1 executes the program of EPROM U3. U1 contains 128 bytes of dynamic RAM built in. R6 and C1 reset U1 at power turn-on to ensure proper startup. EEPROM U5 holds the callsign and other configuration data during power interruptions. RS-232 interface chip U6 links the unit to your computer via J1 for parameter setting.

J2 connects TBOX to your hidden transmitter. Q1 and associated components close the radio's push-to-talk (PTT) circuit. C8, C9, C18, R9, and R10 buffer the transmit audio. Potentiometer VR1 sets proper modulation level.

R11 combines the PTT and audio lines to drive hand-held rigs. For ICOM HTs, use a 3.9k resistor at R11, and hook only the AUDIO output line to the HT's mike input. The same connection works for Yaesu HTs, except that R11 is 2.2k. For non-hand-held transmitters, delete R11 and connect the separate PTT and AUDIO OUT lines to the appropriate pins on a mike plug to mate with your rig.

Let's Build It

If you enjoy wire-wrap assembly, you will have no trouble duplicating Ron's circuit from Figure 1. Be sure to put capacitors C11–C14 and C16 as close as possible to the appropriate ICs to prevent unwanted oscillation and interaction. I suggest socketing all ICs except the +5V regulator. Be sure to use a socket at U3 to permit program upgrading.

If you have access to a "PROM burner," you can program U3 yourself. The latest BIOS program (version 0.7 as of this writing) is available on the 73 BBS at (603) 525-4438. Hams on the West Coast can find it on the NOMAD PCBoard BBS at (805) 498-3500. File names are TBOX07.BIN and TBOX07.DOC.

If you're like me, you would prefer a PC board, and would rather have someone else do the work of making the board and programming the BIOS PROM. Fortunately, N6MBR has done it. Send Ron a check for 35 dollars and ask for the "Homing In" TBOX package. He will mail you a blank 3.25" x 6" double-sided circuit board (see Photo A) and a programmed PROM. He will also throw in one of the hard-to-find EEPROMs for U5.

Of course neither I nor *73 Amateur Radio Today* can warrant this offer. But I can assure you that the six boards used at this spring's Friendship Radio Games foxhunt worked flawlessly. The board is high quality, with plated-through holes. Parts layout details are included.

The ICs in N6MBR's board are so close together that some sockets may not fit. I used pin-line socket strips instead. These are solder-tail socket contacts that come in rows of 25 to 40. Just break off as many as you need for each row of each DIP and solder them onto the board. They are small enough to allow ICs to be side by side only 0.1 inch apart.

Note on the schematic that certain part designators, such as U4, are not used. Also, there are holes and etch for

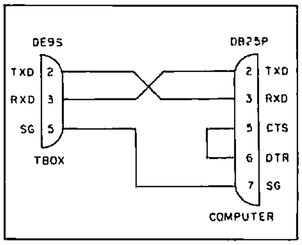

Figure 2. Typical cable connections for computers/terminals with DB-25 RS-232 ports.

Parts List

U1	80C31	CPU
U2	74HCT373	latch
U3	27C256	EPROM
U5	93C46	EEPROM
U6	MAX232	RS-232 interface
U7	7805CTH	voltage regulator
Q1	2N2222A	transistor
D1	1N914	diode
D2	1N4001	diode
X1	12.0 MHz	crystal
J1	DB9PRA	male connector
J2	DB9SRA	female connector

Sources of Parts: ICs, connectors, crystal: JDR Micro Devices, 2233 Branham Lane, San Jose CA 95124. Tel. (800) 538-5000. **PC board, PROM, EEPROM:** Ron Seese N6MBR, 6136 Landino Dr., Westlake Village CA 91362.

additional parts on the printed circuit board. Those parts are not needed for this version of TBOX. Ron is working on new features that use them. I'll have more on that next month.

Capacitor C20 is essential to prevent U7 oscillation when supply leads are long. There are no holes for C20 on the PC board, so "airline" the part on the back of the board.

Firing It Up

Carefully inspect your work after assembly. Pay special attention to polarity of the electrolytic capacitors, particularly those on U6. Check for shorts on the +5V line before installing the ICs.

Install U7 first, then power up the unit and check the +5V bus. If everything is OK, remove power and install the remaining ICs. Now hook up the computer and transmitter interfaces.

Figure 2 shows wiring of a typical cable to connect TBOX to a standard DB-25 RS-232 port. TBOX is configured as Data Terminal Equipment (DTE). This means that TXD on TBOX goes to RXD on the computer, and RXD on TBOX goes to TXD at the computer.

Your computer or terminal program may require a high signal on the DCD line (pin 8 of DB-25). If so, add a jumper from pin 6 to pin 8.

Software and hardware handshaking is not used. Flow control in your terminal program is not necessary, so turn it off. Set the computer to 2400 bps, 8 data bits, and no parity.

Put a dummy load on the transmitter and listen to the TBOX signal on a separate receiver. At power up, TBOX outputs the menu to the computer, then goes into transmit mode. Press the return key on the terminal to stop transmitting, and enter the command mode. When setting parameters, simply enter three digits. For example, to set Mode 2, type "M" and then type "002" without a carriage return.

Your turn to hide the fox may come sooner than you expect, so get started on your TBOX now. Next month, I'll have more on programming and using your tone box. 73

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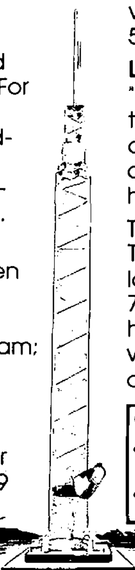

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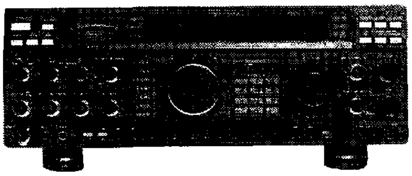

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Have a BLT for Launch

After watching videos and demonstrations of other balloon experiments, members of the Houston AMSAT group decided to put together their own launch effort. Dubbed the BLT (for Balloon Launch Team), they decided to build an inexpensive 2m FM telemetry package for their first flight.

This first package (BLT-1) carried a 100 mW 2m FM transmitter (see the August 1990 issue of *73*) which sent out an audio telemetry sequence. A custom designed analog telemetry system sent out a series of tones seperated with a CW message. The pitch of the tones determined pressure, and inside and outside temperature. The altitude was determined with a pressure sensor circuit designed by John Fleischer of the Transolve Corporation (the circuit appeared in the October 1990 issue of *Radio-Electronics*). The original design was meant to be used up to 20,000 feet on model rockets, but the BLT group used just the analog portion and recalibrated it to operate up to over 100,000 feet. Since the package didn't generate a lot of heat, Andy WA5ZIB included a chemical heat pack to keep things warm during the flight.

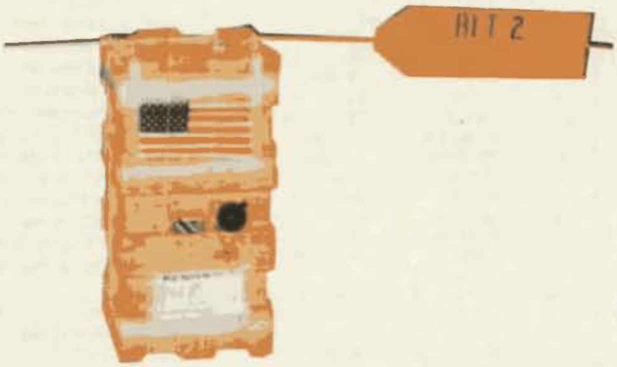

Photo C. The second (and third) BLT payload. The weathervane helped maintain stability during the flight. Note the Radio Shack beeper which helped the chase team to hear the downed payload. The TV camera/mirror is on the other side of the payload.

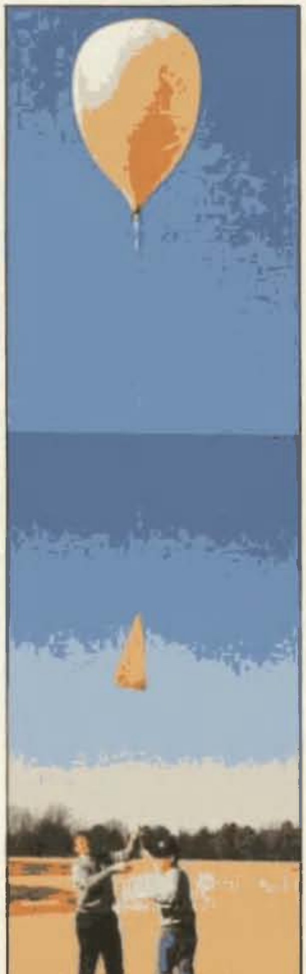

Photo A. Burns Cleland WB5HLZ (left) and Allan Fox N5LKJ (right) prepare to launch a BLT special to the edge of space.

Photo B. Andy MacAllister WA5ZIB puts the finishing touches on the first BLT experiment.

On December 8, 1990 the BLT group sent their first payload up from the Huntsville Texas Municipal Airport. After a great flight up to over 100,000 feet, the package parachuted down to land about 30 miles to the south near the town of Magnolia. Reception of the telemetry signal was observed over a wide area of Texas and Louisiana.

Recovery Texas Style

After a long search, the chase crew eventually pinned down the landing site about a mile or two off of the main highway. Things were going well until they asked the ranch owner if they could search for their package. He replied, "NO, come back tomorrow!" Nothing more frustrating than hearing your payload crying out for help and not being able to do anything about it.

The dejected tracking crew almost decided to risk their lives and go in anyways but thought better of it. A couple of trackers returned the next day and to their amazement the payload was still transmitting! The landowner took them back through several locked gates as they closed in on the package. It turned out the payload had parachuted down in the middle of a large private (and heavily patrolled) hunting preserve! After a short search they found the payload hanging about 80 feet up in a tree.

One of their escorts disappeared for a few minutes and returned with his rifle. With just a few shots, he cut the string (90 feet away) and brought the payload tumbling down out of the tree. Everyone was thankful they had the foresight not to trespass the night before!

BLT-2

With the success of their first flight, the South Texas Balloon Launch Team embarked on a much more ambitious effort. This payload contained an ATV transmitter with a live TV camera (GBC CCD-100), active mirror control (to point periodically at the horizon or the ground), digital voice ID on the video subcarrier (the messages changed with various stages of the flight—one of them actually said, "I'm falling" during the parachute descent), a CW HF

Photo D. The chase team recovers the first BLT payload nearly 30 hours after launch...and it's still ticking! L to R: Mike WA5TWT, Mike N5QMG, Burns WB5HLZ, and James N5PRQ

The Balloon Launch Team of South Texas

High Coordinator	WB5HLZ
Payload Master	WA5ZIB
Payload Integrator	WA5TWT
Captain Video	N5JXO
Computer Wizard	WB5TTS
Earth Software	N5LCO
Analog telemetry	WA5ZIB
Antennas	N5EM
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Back-up power	N5SUA
Balloon system	WB5HLZ
Camera system	WA5LHM
DF leader	KC5CP
Digital voice	N5JXO
Flight computer	WB5TTS
Flight plan	WB5HLZ & WB8ELK
Flight software	WB5TTS
Mirror system	N5RPQ
Net control	WB5HJV
Power system	WB5HLZ
Telemetry software	N5JCO
Thermal control	WA5TWT
Tracking software	WB8ELK
VHF transmitter	WA5ZIB
Video ID/sequencer	WB8ELK
10m beacon	K7IRK
Weatherman	KA3BKU

The Whole BLT Crew: WD5BDX, WB5BGQ, KA3BKU, KC5CP, WD5DZC, WB8ELK, N5EM, WB5HJV, WB5HLZ, N5JXO, WD5JRD, N5LCO, WA5LHM, N5LKJ, N5MPN, WA5PCD, N5QMG, N5RPQ, N5SUA, WB5TTS, WA5TWT, WB5UUK, WA5WOD, WA5ZIB, A. Alexy, J. Edinburgh, J. Johnson, J. McKelvy, J. Mock, S. Ross, C. Summerville, Civil Air Patrol, Brazos Valley ARC and Electronic Parts Outlet.

beacon on 10m, and 2m FM telemetry that even included a packet telemetry downlink from the onboard flight computer.

The flight computer took the analog telemetry signals and converted them to ASCII text for the packet and CW downlink. It also controlled the TV camera mirror. During ascent, the computer would cycle the mirror to point at the ground or the horizon every 50 seconds. During the parachute ride back to earth, the mirror stayed in the down position to look for distinguishing landmarks on the ground.

Crash!

BLT-2 was launched from the Wharton Texas Municipal airport on the morning of May 11, 1991. Due to 10 mph winds, the balloon crashed into the side of a hangar just seconds after liftoff! The 10m CW beacon transmitter (a 28.322 MHz Fireball transmitter built by Bob Moody K7IRK—see the November 1990 issue of *73*) was ripped off the package along with the ATV antenna. The flight computer reset to a dormant mode and the stabilization fin fluttered back to the ground. The balloon and what was left of BLT-2 headed skyward (fortunately the 2m beacon still worked). Spirits were definitely not as high as the balloon at this point. Fortunately the balloon burst prematurely at 27,000 feet (probably due to the crash). The direction-finding crew went into action and quickly found the package 12 miles away in a field near Egypt (Texas). It was noon, so the crew dusted off the payload, reset the computer, glued the ATV antenna back on, and re-attached the 10m beacon. It was time to try again.

Two Flights in One Day

The hastily refurbished BLT-3 was ready to fly. This time the launch team carefully choreographed the release sequence which resulted in a beautiful takeoff (no crashes this time).

Fantastic live camera images from the payload delighted everyone watching the ATV receiver at the launch site. Telemetry from the packet downlink was displayed on laptop computers at mission control as well as by the chase crew. Those without packet stations had a blast decoding the CW telemetry. The ATV signal was received as far away as Dallas (over 250 miles) and the 2m FM telemetry could be heard on HTs at that distance as well. The 50 milliwatt 10 Fireball beacon was even heard 500 miles away (groundwave) by Warren W5DFU in Tulsa, Oklahoma.

This time the balloon landed 18 miles to the north in a hayfield near Wallis. The now-experienced chase team found the payload in short order. A lot of fun and adventure was had by all. Look for future flights from the South Texas BLT. ■

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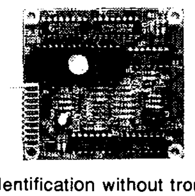

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Notes from FN42

Lots of news this month, and promises of more to come: Zafizis Tzobakas SV2AHT will report on the mountain climbers of Greece, who made another trip to the high country with an expedition to Pamir of the Himalayas last July. Jonas Paskauskas LY2ZZ will provide us with the results of the Ham Conference that took place in June. And we have another volunteer Hambassador, Ed Sershon DL/N7PHY. He and his wife have moved to Germany from Seattle, Washington, USA and expect to be there for many years. If you have information for him, send it to Ed Sershon, Ferdinand Thomas Weg 6, 3389 Braunlage, Germany.

Skip Westrich WB8OWM wrote us a nice letter to let us know how much he enjoyed the article about "Box 88 Moscow." He also wrote to Ron Gang 4X1MK, who had submitted the article compiled by Oded 4X4SO. Thank you, Skip. We appreciate feedback from our readers. Those of you who have special wishes as to what you would like to see in this column from other parts of the world, please write! I can put the request in the column.

73 receives many beautiful OSL cards each month. Since only one can be chosen for "OSL of the Month," Associate Editor Joyce Sawtelle slips me the best of the rest, to see if I can use them in my column. Even though these cards do not win the free one-year subscription, at least they are published for all to enjoy.

The one I really enjoyed this month was submitted by Gonzalo De Murga CX6RN for his radio club, CX1RA. The DX team from his club uses the call sign CV1R. The lighthouse on the card was built in 1876. Note the sea lions on the rocks. The lighthouse on the Isla de Lobos ("Island of Wolves") would make a dandy radio tower, don't you think?—Arnie, N1BAC

Roundup

Czechoslovakia From a letter from Jiri Pecek OK2QX, translated by OK2YN, on "Czechoslovak Radio Amateurs and the Council of Europe DXpedition TP5OK."

The Council of Europe (C.E.) in Strasbourg, France has 42 years of history, founded in 1949. The group of active radio amateurs associated with this organization initiated the Council of Europe Radio Amateur Club (CERAC), similar to the radio clubs at the United Nations and the International Telecommunications Union. The president of CERAC is Mr. W. Rossle, who is also the director of the audio visual service of the C.E. The primary force behind the ham activity is Mr. Francis Kremer, F6FQK, the appointed director of the special event station with the permanent callsign of TP2CE.

The station is situated in an extraterritorial area in the main building of the C.E. Even though it should have the same rights and status as 4U1ITU, it has not been recognized as a separate country yet by the DXCC Committee.

There have been eight short DXpeditions to TP2CE in the past. It has been proposed to activate this callsign on the occasions of admitting new members to the C.E. For example, when Hungary was admitted last November. At that time it used the callsign of TP5HA.

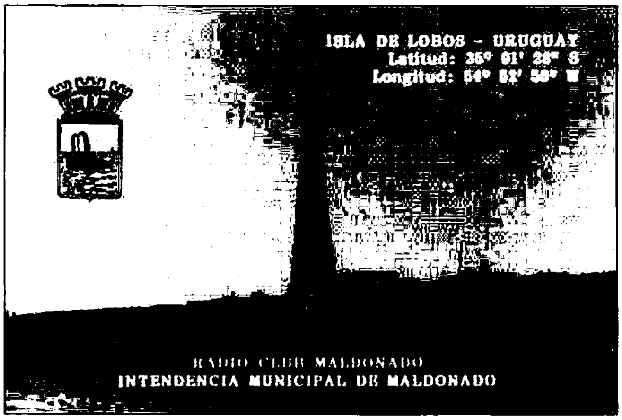

Photo A. QSL card for CV1R and CX1RA (other side) of Maldonado, Uruguay, South America.

I was given the opportunity to take part in activation of this station at the end of 1990. After exchanging some letters with our Federal Ministry of Foreign Affairs, CERAC and the representatives of the F.I.S.A.I.C. in Czechoslovakia organized the DXpedition as the event of the Association of the Czechoslovak Radio Amateurs Railroaders, as I am also president of the newly formed branch of the F.I.S.A.I.C. Thanks to the kind support of the headquarters of our State Railroads and of the F.I.S.A.I.C., the railroad transportation was at no cost.

I arrived in Strasbourg on Friday afternoon, April 26, at the railway station, but in spite of previous arrangements no one was there to meet me. I was in a strange country without knowledge of the language, but the local police gave me directions to the C.E. building.

The operation of the station was teamwork with the aforementioned people, Philippe F6GOC (physician and technician) and Santiago FD1RAY (ex EA4EII, DA4BJ, and TJ1/EA4EII), the permanent ambassador of Spain in the C.E.

At first the equipment used was a Kenwood TS-440 and SB-200 amp, but Philippe brought an ICOM IC-761 and power amp (800 watts out) the following day. The antennas were a 5-element beam for 20/15/10, a dipole for 40 meters, and a 3-element fixed beam for 80 meters. My operation was on SSB only, but the next DXpedition will be CW only.

We logged on a laptop computer which was really nice, except that the French keyboard was not the classic QWERTY keying which caused me to have to search for each key individually. To increase the speed of operation we helped one another by one operating and the other logging. This did not work very well when I was operating in the Czech language or beating down the pile-up of U-stations in Russian because the logger did not understand those languages. At those times I had to keep the log myself.

In spite of all the problems, we made 1,718 contacts in about 26 hours. The last contact was made at about 1700 on Sunday, and I was on the Eurocity Express departing at 1807.

The callsign used, TP5OK, will never be heard again, as it was used on the occasion of admitting Czechoslovakia to the C.E. as its 25th member. The next activity of this station should be later this year, probably during the occasion of admitting Poland to the C.E. with the callsign of TP5SP.

This event was good training for future DXpeditions. I am hoping to visit ZA-land in the future and wish to be the first to operate there. I am in contact with the Embassy of Albania in Prague which is attempting to help me. I hope that future DXpeditions will receive the support from the Czechoslovak Radio Amateurs Society.

The CERAC issues two diplomas: the first, the Council of Europe Award, for contacts with the member countries of the Council of Europe; the second, the European World Wide Award (EWWA), for distinguished countries from all the world round. Those interested may apply—the diplomas are worth it! *[OK2QX, Jiri Pecek, Riedlova 12, 750 02 Prerov, Czechoslovakia.]*

Japan From the JARL Newsletter: BAND PLAN: Up to now the JARL has formulated an amateur band plan by listening to the demands of amateur radio operators, but now the Ministry of Posts and Telecommunications has officially issued a band plan.

The purpose of this decision is to give the plan authority according to radio law, and to encourage efficient and orderly use of amateur bands by placing a legal requirement on all amateur radio station licensees, whether they are JARL members or not, to adhere to the band plan.

Silent Key: On May 20, the first woman amateur radio operator in Japan, Mrs. Chiyono Suzuki (nee Sugita), ex J2IX, died at the age of 84. She became the first YL ham on October 14, 1933, in pursuance of the will of her elder brother, Mr. Toshio Sugita J1DN, when he died suddenly. After WWII, Mrs. Suzuki was known to have become very active once again under the callsigns JG1WKS and JJ1SNC.

8J1RL, Antarctic: JARL has received a letter from Mr. Toyoshi Arisawa JA4EDV, a member of the 32nd Japanese Antarctic Research Expedition (JARE) team, who left Tokyo for the Antarctic on November 14, last year. The current state of amateur radio operations is:

1. General state of operations: Almost all QSOs are made on 21 MHZ during lunch break, 12:30–13:00 local time (0930–1000 UTC) Monday through Friday. The total number of stations worked as of May 21 was 560.
2. 8J1RL: A tower about 15 meters high is being used for normal operations. At present we have three projects planned—a new pole intended for Europe, a dipole for 7 MHz, and an antenna for other WARC bands.
3. Miscellaneous: HF packet was operated experimentally from May 6 to May 19. A beacon at 21.1045 succeeded in making contact with JF1SNA in Japan on May 9, 0907 UTC. This was probably the first official packet communication ever effected between Showa Base and mainland Japan.

Latvia A letter from the Kipsala DX Club in Riga: 1. Yuri Baltin YL2DX started another polar trip on July 1 to several new IOTA islands and F.J.L. in the Russian Arctic: 4K2DX, 4K3DX, and 4K4DX. All QSLs only via the manager, Mrs. Aifa Dimde, YLR-48-18, P. Kaste 18, Riga, 226048, Republic of Latvia, Europe. Please SAE with return postage. Do not put on envelopes any callsigns, and wrap all contents reliably.

2. Aifa Dimde will only keep for the next six months the logs and QSLs of the following active stations: EK1KP (Graham Bell Is., F.J.L., Aug. 1990), EKØAC (Komi Rep. & Yamal Reg., ONLY March 1991), RQ2WCY (World Comm. Year, Nov.–Dec. 1983), UAØK/UZ3AXX (Keperweem, Chukotka, July 1990), UK2GAB (1974–1984), UQ1GWX (1985-1990), UQ1GXX (1984–1989), UQØGZZ (only Jan. 1985), YL2RG (Special Stn., Dec. 1988–Jan. 1989, Oct. 1989), and YL2ØØSM (S. Morse Bicentenary, April 1991).

3. Any ham having at least five QSOs in CW during April 1991 with Memorial S. Morse stations (such as YL2ØØSM, MØRSE, VI91SM, 3A2ØØSM, I2ØØM . . . etc.) can get a splendid special TROPHY from the YLCWG in memory

times on four separate bands (i.e., at least two separate calls must have been worked).

Send only log data of QSOs along with your complete address plus 36 IRCs by registered mail to the manager, Mrs. A. Dimde, not later than Dec 1, 1991.

4. New QSL routes for YL1XX, YL2DX, and YL25RF: 226001, Riga-1, P.K.10, Ostrzygallo, Republic of Latvia, Europe. Please mail as above, and without the telltale bulge of a folded SAE.

5. The Soviet QSL Bureau, Box 88 Moscow, does NOT work for Latvian hams (all YL, UQs) any more.

Lithuania *[Article from a Colorado newspaper read during my vacation.—Arnie]* From the Rocky Mountain News, July 14, 1991, by Holger Jensen, News International Editor: Lithuanian ham told world of Soviet invasion. "One of the unsung heroes of Lithuania's drive for independence is Gintas Sakenas, a ham radio operator better known to American hams by his callsign LY2BKW.

"When Soviet Interior Ministry troops, the notorious Black Berets, invaded Vilnius, the capital of Lithuania on Jan. 13, he was the first to inform the outside world.

"For 14 hours, Sakenas was the sole source of uncensored information from his homeland—the Soviets had seized all regular broadcast stations, TV networks, and other news outlets in Lithuania, and had surrounded parliament."

Along with information about the situation, Sakenas also provided a relay from hams in the parliament building. After 14 hours of operation, he received a tip that the Soviets had traced his signal and he had to shut down. Several weeks later he was able to return to the air to reassure hams that he was okay.

Sakenas was in the United States as a treat provided by four American hams: Richard High WØHEP of Aurora, Colorado; Budd Drummond WJ6Q of Redding, California; Wayne Peterson of K6ZSJ of Woodside, California; and Chuck Carpenter N6CFQ of Riverside, California.

"Sakenas is convinced his republic eventually will get its independence. And he concedes he probably won't be able to take any more two-month vacations when it shifts from a state-controlled to a free-market economy." But, Sakenas said, "It will be worth it. We were independent before Stalin annexed Lithuania, so we know how to stand on our own two feet."

Saudi Arabia Media Release from the Ministry of P.T.T., Kingdom of Saudi Arabia: Saudi Arabia will display the Kingdom's up-to-the-minute communications technology in a pavilion of traditional Arabian architecture during the world's most prestigious telecommunications exhibition, Telecom 91, this October 7–15 in Geneva, Switzerland. The theme of the Saudi pavilion will be "The Cradle of Islam Speaks."

The Saudi Minister for Post, Telegraph and Telephone, Dr. Alawi Darweesh Kayal, said Saudi Arabia's display would be a significant part of Telecom 91, the 6th four-yearly world telecommunications exhibition and forum.

The Kingdom's telecommunications web, including 5,000 kilometres of coaxial cable and more than 450 microwave radio towers covering 15,000 kilometres, is considered the Middle East pace-setter, and one of the world's most modern networks. It is among the first to move towards all electronic telephone exchanges. It combines satellite, microwave radio, optical fibre, and submarine cable systems.

Switzerland From the International Telecommunications Union (ITU) Press: With the aim of highlighting worldwide production of quality films and videos, the ITU will host the 6th International Film/Video Festival on Telecommunications and Electronics: GOLDEN ANTENNA 91, in Geneva from 7–15 October 1991. This exhibition has met with increasing success since 1971. It is open to the 164 member countries of the ITU, to exhibitors at TELECOM 91, and to representatives of the telecommunication industry.

As of 10 June the headquarters had received 78 entries from 18 countries and three regional organizations. *[What I find interesting to note is that Japan and the Japan Amateur Radio League, Inc. was the only country and organization to have submitted a ham oriented film/video as of June 10. Their presentation is on JAS-1b/FUJI-2, Amateur Satellite Communications.—Arnie]*

Yugoslavia/Slovenia Packet message passed on by Ron Gang 4X1MK as sent by Iztok YU3FK: *[The packet message was sent to ALL BBSs in Europe on the subject of "war and hams" in Slovenia.—Arnie]* The message tells of how the hams in Slovenia responded to the emergency. Most of the ham communications were helping the press (some telephone lines were broken) and the Red Cross. A lot of personal requests were handled by the hams. Most of the operations were found on 2m and 70cm FM, and a net was on 3.605 SSB.

Luckily only one ham installation was destroyed, even though many of the sites were attacked because they were TV and communication centers. Even though the 23cm backbone was disrupted by these attacks, the 2m links were ready, and the YU3 packet network remained fully operational. No harm was done to the 2m and 70cm FM repeaters.

Packet node 4N3H was probably the first ham packet node to be destroyed in a military attack. It had four antennas on 23cm to 38,400 baud YT3MV 23cm station (4N3H-12), a 2m port on 144.600 (4N3H), and a converse node 4N3H-3. They were also developing a wide-bandwidth 19,200 baud Manchester user access node on 70cm.

Writes YU3FK: "When unexpected attack of YU Army to Slovenija happened, the first hams reaction was: be QRV, stay tuned . . . we blocked military repeaters and simplex channels on 2m . . . . Later on, we were requested not to make QRM on military QRGs because we blocked channels so effectively YU3 intelligence could not get any information from military communications.

"As my role in packet, my first action was to check network. I sent a few bulletins with emergency instructions to BBSes . . . When army started bombing of TV and communication centers, where most packet nodes were, we prepared secondary links . . . ."

REPUBLIC OF KOREA

Byong-joo Cho HL5AP
P.O. Box 4, Haeundae
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Republic of Korea

17th World Boy Scout Jamboree

Celebrating the 17th World Jamboree, the Korean Boy Scout League will be operating a special amateur radio station with help from the Korean Amateur Radio League. The special callsigns will be 6K17WJ and 6K91WJ. The operation location will be KDN-

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The conditions of issuance of a commemoration award are: Class A—6 HL call areas (HL1-HL5, and a scout 0 station) with any one of the special stations; Class B—Any HL call areas (HL1-HL5, and a scout 0 station); Class C—Only any HL stations and special station spelling "WORLD JAMBOREE" with their last suffix letter, such as, W = HL0*W*, O = HL2AK*O*, R = HL3FU*R*, L = HL4LY*L*, etc.

Needed to apply: (a) GRC list and IRCs/$5.00 (Korean station, W3,000) plus applicant's QSL card; (b) Operation period of commemorative station from 8 Aug 1991 to 16 Aug 1991; (c) Valid HL stations from 1 Jan. 1991 to 31 Dec. 1991, scout club station has no time restrictions; (d) Application deadline requirement, 31 March 1992 (effective post office date stamp).

Send applications to: Mr. Young Tee, Lee HL4CGU, Chief Team, Amateur Radio, 17th World Jamboree, P.O. Box 208, Wan Do, Jun Nam, 537-800, Rep. of Korea.

LITHUANIA

Jonas Paskauskas LY2ZZ
P.O. Box 71
Siauliai 235400
Lithuania

There were 10 special event stations operating during the 4th World Lithuanian Sports Festival from July 27 to August 15, 1991. The stations operated all bands and all modes using special callsigns of LY91??.

For those wishing to receive a commemorative pennant: in Europe you must contact at least three special event stations, and North America and other areas must make contact with at least 2 special event stations. Send your log information only and 10 IRCs to: Paul Pauliukonis, P.O. Box 321, Strafford NH 03884, USA.

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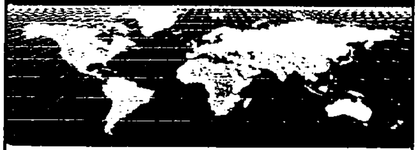

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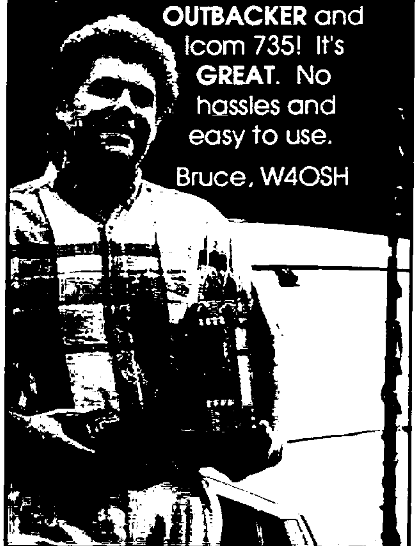

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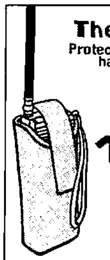

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Parts, Kits, and Scrounging

Most of the mail I receive is brief, and many of you take advantage of the mini-kits I put together. I hope this service is valuable to you. With the vast quantities of surplus material available in Southern California, I am able to obtain the components and PC board, minimizing the cost of the projects.

Sometimes the time and effort required to ferret out these items becomes a consuming burden, but the search and acquire mission built in me is quite strong. I look for items not in one's or two's, but in large quantities. The prime reason that I provide components and kits is to promote homebrewing.

I try to combine the basic starting block, a PC board, and key components at a modest cost to cover expenses. Some of the components required for these microwave and VHF projects are not easily found in your local parts store. Try to purchase a chip capacitor in almost any city, and you will meet more problems than you started with.

If you can't make it to a large hamfest like Dayton and stock up for the winter, you must depend entirely on mail-order houses or some really good scrounging. That's OK, but if you must purchase everything on a part basis, costs can be quite high.

Some of you asked about where you could purchase a small quantity of #26–36 guage wire for winding coils. I'd never given something this inexpensive a second thought. To me, this item is readily available, and I never considered how tough it could be to obtain in other parts of the country. I buy it in a scrap metal yard at $2 a pound. In the future, I will include some wire in the kits I put together, or I'll send it on request, when available. Keep in mind that I am not an electronics store, and I don't have a full stock of components; I am just trying to be helpful.

Mailbox Questions

John VE4HL, picking up an old issue of *73* and reading my column, asks an often-asked question: "Is the kit still available and the price still the same?" Bob WA4JOM asks other common questions: "Do you have a packet address?" "What are you offering the microwave explorer?" "What is the price?" George KD9EN inquires about parts: "Do you have any Gunn diodes or Gunn oscillator cavities?"

The question about price is easy to answer. The kits still cost the same. At least for the present, I haven't made any adjustments to keep pace with the increases in postal and shipping rates.

As for a packet address, I don't have a packet station on the air yet. I have neglected this mode of operation primarily due to my main interest in microwave operation.

The MOSFET (for the switching power supply) and the Gunn diodes are still available, as are most of the printed circuit boards from past projects. I make my own PC boards, and as such, have many other boards available that I have never listed before. I have a 100-year-old graphic arts camera that takes a piece of film 12" x 10", and allows me to reproduce almost anything. I also have large quantities of sheet film, and can help you prepare a negative. Drop me a line, and time permitting, I might be able to help you out on one of your projects.

The next frequently asked question is, "What is the most popular kit?" I believe It's the 30 MHz IF amplifier, Gunn modulator kit, for use with a burglar alarm type (10 GHz) Gunn oscillator and detector. It can be used directly with the MaComm Gunplexers™ unit. See the following list for the month and year of the issue that this appeared in *73*. Since then, an improved PC board has been developed, covering most of the frills while still using the TDA-7000 chip. This single chip FM receiver made this kit possible.

About this time I coined the phrase "microwave building blocks," referring to modular components used in upgrading and constructing devices. Rather than building on a motherboard, the project consisted of interconnected, easy to change modules. Most of the kits are for constructing these modules. They range from simple items to a miniature microwave RF amplifier for 10 GHz.

Kits Available

Here is a list for your convenience:

•1296 DBM (Oct. 1987). Cost, $10. The 1296 MHz mixer is a 1-1/2" square of 0.015" Teflon™ PC board. The double-balanced mixer was intended for 1296 MHz. It works well from 450 MHz to 2 GHz.

•1296 ATV Converter (Oct. 1985). Cost, $5. This simple voltage tune converter for ATV on 1296 MHz uses a single MRF-901 oscillator (the IF amplifier uses one, too).

•10 GHz Preamp (Aug. 1989). Cost, $20. The 10 GHz preamp uses two MGF-4102 GaAsFETs with a no-tune design, giving 18 dB gain at a 3 dB noise figure. This is the amplifier that I use for receive; in transmit, it drives my TWT for high power on 10 GHz SSB. An additional power supply for the preamp that uses a switch mode power supply for negative 9 volts (gate bias) is included with the PC board for an additional $5.

•60 kHz Antenna (Feb. 1990). Cost, $14. The original surplus ferrite rods for this kit are out of stock. A replacement exists, but it's full-size, instead of five rods like the original kit. The cost of the full-size rod, plus additional postage to ensure its arrival without breakage, has increased the price. With the WWV 60 kHz, the 60 kHz antenna is a calibrator for your frequency counter's timebase.

•10 GHz Fun 30 MHz IF System for Gunn Transceivers (April 1990). Cost, $10 for PC board and TDA-7000 single chip FM receiver. The 10 GHz, 30 MHz IF system is a single chip transceiver controller at 30 MHz for use with a Gunn oscillator on 10 GHz wideband FM. It controls voltages and modulation for the Funn oscillator. The TDA-7000 is a complete 30 MHz FM receiver on a single chip.

On their DXpedition to Baja California, Chip N6CA and Jack N6XQ spent many evenings camped along the beach.

•CW EPROM Keyer (June 1990). Cost, $12.50. The CW EPROM is a keyer identifier with your callsign built in for use with a 10 GHz wideband FM system. Turn on DC power, and it outputs your call in low level audio to modulate the 10 GHz WBFM oscillator.

•FET Switching P/S (Aug. 1990). Cost, $15. Extra pair of FETs, $5. The FET switch Is a simple controlled power supply that can be used to develop low power 110 AC (100W) or to construct a toroid transformer and convert 12 volts DC to 24 volts or more. It's about the size of a cigarette pack. I use one to obtain 1200 volts at 4 mA for the photo multiplier part of a laser receiver.

•5.6 GHz Converter (Dec. 1990). Cost, $15. PC board for 5.6 GHz, both receive and transmit MGF-1302 amps. Dual mixers with preamp for 2 meter IF, and transmit attenuator for transmit at 2 meter drive. Requires a local oscillator source, either crystal multiplier or brick phase-lock loop. Design by DJ6EP and DC0DA, courtesy The North Texas Microwave Society.

•6 GHz Brick PLL Oscillator (Dec. 1990). Cost, $50. The brick Is a phase-locked oscillator requiring modification of its output filter. (I re-tune them for you.) The brick requires an external crystal oscillator at approximately 100 MHz. Shortly (next month) a 10 GHz PLL brick will be offered that has the internal crystal oscillator and oven control.

•Gunn Diodes 50 mW at 10 GHz (Jan. 1991). Cost, $5; 100 mW Gunn diodes at 10 GHz, $10. The Gunn diodes are still available, and the 50 mW devices are no problem. However, I am having difficulty obtaining 100 mW devices. In bench tests, I have to test about 20 devices at 50 mW before finding a hot one at 100 mW.

•10 GHz Slot Antenna (March 1991). Cost, $40. This is a beacon waveguide antenna constructed from a section of WG-16 waveguide. It produces about 6 dB gain, and is omnidirectional. The kit includes all parts, a precut and machined waveguide with top shorting end plate, and a gold plated brass waveguide (WG-16) flange.

That's the list for now. More will be added to this list in the future. I hope this answers your questions about the kits. For more information, write to me, or to *73 Magazine* for back issues or copies of the articles and columns. Better yet, subscribe and don't miss out.

Recent Mailbox Question

Larry (callsign pending) has heard that it is possible to work DX at VHF and UHF frequencies by bouncing signals off the moon. He writes: "Is this true, or is someone pulling my leg?"

Many amateurs work moonbounce (or EME, Earth-Moon-Earth) from continent to continent on frequencies from 2 meters to 10 GHz. Look in the back sections of ARRL handbooks and you'll see equipment for this purpose.

Chapter 10 of *The ARRL UHF/*

Number 16 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andrew C. MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083-5640

OSCAR-22 Launched!

On July 17, five payloads were placed in low earth orbit by the Ariane space V-44 launch from Kourou, French Guiana. They included the primary payload Earth Resources Satellite (ERS-1) and four micro-satellites. Among the microsats was UoSAT-F, now called UoSAT-5 or UoSAT-OSCAR-22. OSCAR stands for Orbiting Satellite Carrying Amateur Radio.

The other microsats included TUBSAT, SARA and ORBCOM-X. They were mounted on the Ariane Structure for Auxilary Payloads (ASAP). This arrangement of mounting small satellites on a ring at the base of the main payload was used successfully for the January 1990 launch of six amateur satellites, OSCARs 14–19.

TUBSAT is the first microsatellite built by the Technical University of Berlin. Its mission is to track storks (really, storks!) with radio location beacons. It also incorporates an experimental Charged Coupled Device (CCD) camera star tracker for satellite attitude determination.

SARA is a radio astronomy satellite designed to listen to Jupiter's radio emissions in the 2–15 MHz range and transmit telemetry on 145.955 MHz. This project came from ESIEE SPACE, a club at the French "Ecole Superieure d'Ingenieurs en Electrotechnique et Electronique." Although ESIEE SPACE was originally founded to build and launch experimental rockets, the group built their first satellite in conjunction with the French National Space Agency, CNES. Some have questioned their use of an amateur frequency for the downlink, but it's up now, on the air, and can't be changed.

ORBCOM-X is a small satellite built by Orbital Sciences Corporation as a prototype of their proposed constellation of low-earth-orbit communications satellites. The team responsible for this effort included AMSAT Vice-President of Engineering Jan King W3GEY, Gordon Hardman K7KD, and Jeff Zerr. They were all pivotal players in the AMSAT Microsat Project.

A Look at UoSAT-OSCAR-22

U-O-22 is the fifth satellite in the University of Surrey series of small, low-cost spacecraft. It uses the same basic structure and electronics configuration as UoSAT-OSCARs-14 and -15 but with several differences. Originally the satellite was to have no amateur radio operations on board. Its primary mission was to provide PACSAT-style communications for medical and technical information services in developing countries on nonamateur frequencies. Organizations including SatelLife *[see "QRX" in the September issue]*, VITA, and the National Science Foundation were involved. AMSAT's former President Vern "Rip" Riportella WA2LQQ is the SatelLife Technical Director, while Jon Metzger N1IJP is the SatelLife Ground Station Manager. The HealthNet communications operation is still the primary focus of the satellite, but other experiments and ham radio operations are now a part of the package.

The U-O-22 Solar Cell Technology Experiment (SCTE) monitors the performance of a wide range of solar cells mounted on the spacecraft. Cells made from indium phosphate, gallium arsenide, and silicon are included to determine the long-term effects of space radiation on the electrical characteristics of the different cells. This will assist future satellite designers with solar cell choices for future spacecraft. The space radiation is monitored by RADFETS. The readings are then sent by the telemetry system to ground stations for study.

U-O-22 carries a CCD camera. The images are black and white with 256 grey levels and a resolution of 578 by 576 pixels. The images seen by the camera are about 1000 miles square, allowing easy identification of ground features. The pictures are captured to the onboard RAM disk for later broadcast to ground stations.

The pictures are sent via packet on 435.120 MHz at 9600 bps using Frequency Shift Keying (FSK). Image display programs were not readily available in the first days after launch, so several pictures were converted to GIF files and distributed to various BBS systems, including CompuServe and the Dallas Remote Imaging Group (DRIG) BBS (214-394-7438). Some of these processed pictures were also uplinked to U-O-14 for transmission from that satellite. U-O-22's gravity-gradient and magnetorquer attitude control system provides a stable system for reliable earth imaging. The satellite camera is always aimed toward the earth.

Ground Station Equipment

Stations already equipped for activity via U-O-14 need no changes to receive the data, messages and pictures from U-O-22. New users will need a 70cm receiver, FSK demodulator, and a packet terminal node controller (TNC) capable of KISS operation. Although 9600 bps modems are more difficult to work with compared to 1200 bps systems, more information has become available on 9600 bps systems from AMSAT both here and in the United Kingdom. Simple omnidirectional antennas are adequate for U-O-22 reception.

Several software programs have been in development for decoding and displaying telemetry from U-O-22, but the most important software is either PB.EXE or NET.EXE. These programs are designed to receive the Broadcast Protocal files sent from the satellite. They are available as shareware through BBS systems or directly from AMSAT-NA in Washington for a handling fee. Call (301) 589-6062 or write to AMSAT-NA, 850 Sligo Ave. #600, Silver Spring MD 20910-4703.

Other programs of interest from AMSAT-UK in London include DTLM.EXE for displaying telemetry from the UoSATs and microsats, SPLOT.EXE for graphing telemetry results, and UO5TLM.EXE for specifically collecting, displaying and archiving U-O-22 telemetry. Programs for picture display are expected soon. Some of these programs may also be available from AMSAT-NA.

U-O-22 Commissioning

When U-O-22 went into orbit on July 17, it was launched with all systems off. During the first pass over the United Kingdom, the ground control station powered the satellite up with the 70cm transmitter operating at the 2 watt level. Data was at 1200 bps. The onboard computer was then activated and the backup transmitter turned on because the primary transmitter was acting up with intermittant output.

After six passes over the UK, the data downlink was switched to 9600 bps and several systems including the AX.25 packet output and RAM disk were successfully activated. The previous transmitter problems were no longer occurring, and all systems seemed operational.

Forty-six hours after launch, the magnetorquers were enabled to stop the tumbling motion of the satellite. A day later U-O-22 was sufficiently stable to extend the gravity-gradient boom. Unlike previous UoSATs, where the extension of the boom is gradual, this one deploys telescopically with one firing to a length of 16 feet in only a few seconds. Gravity-gradient lock was achieved, and the satellite orientation became stable with the camera always aimed toward the earth. The magnetometer and sun angle sensors work in conjunction with the onboard attitude control software to maintain the satellite's position using the magnetorquers.

Four days after launch the ground control team began work with the CCD camera experiment. The first picture was downloaded to NK6K in California. It showed overexposure and cloud cover. Subsequent shots displayed spectacular views of the Mediterranean with excellent clarity and easily-identifiable land features. For those with CompuServe access, the first good picture file showing a clear view of Italy can be downloaded from the HAMNET as CCD1A.GIF.

By July 29, the initial phase of U-O-22's commissioning was complete. All the subsystems had been exercised and proven functional. Some debugging of the onboard computer and the CCD Transputer software continues, but for now, the amateur side of this new satellite is performing flawlessly.

UoSAT-OSCAR-22 Frequency Plan

Downlink:	Uplink:
435.120 MHz	145.900 MHz
9600 bps FSK	9600 bps FSK
1200 bps AFSK (backup)	1200 bps AFSK (backup)
5 watts or 2 watts	

ABOVE AND BEYOND

Continued from page 60

Microwave Experimenters Manual covers EME calculations in depth, and gives a very good history of its development and applications.

DXpedition to Baja

Recently Jack N6XQ and Chip N6CA took a trip to Baja for some DXing, which required some intensive navigation of Baja's narrow roads and nasty potholes, not to mention wandering burros. Jack and Chip thought they were home safe when they landed at the Tijuana airport. (They left their van in lower Baja for a return trip on July 8 for more hamming activities.) Little did they know that the most dangerous part of the trip was about to begin with a Tijuana taxi trip to the border. Jack stated that "The driver obviously had computer training, as his throttle had a binary control." They almost had two serious accidents in the very short trip to the border.

Jack reports that cautious driving rewarded them with a pleasant trip. In seven days they had traversed over 17 of Baja's 24 different grid squares. They camped on some beautiful beaches, including one in DL37 for two nights. Finding camping spots in Baja is easy, as the state is sparsely populated and forest rangers will give you directions. The Sea of Cortez was noticeably warmer than the Pacific Ocean. The last day they spent on the beach in DL53, with a refreshing breeze.

The QSO count came in around 250, with the bulk on 6 meters. Nice double hop to the East Coast on Saturday morning of the contest weekend, with strong "E's" from DL43 to Southern California, Nevada, and Arizona, on the evening of June 11. Several stations with whip antennas dropped power to less than a watt. On the 12th, operation was from Cabo San Lucas DL42 and DL52, but luck ran out and there was no opening. Camping in DL53, they caught a few more "E" openings into Colorado and meteor scatter propagation into Phoenix and W5FF. Thursday morning the 13th was the biggie, with openings into the 5, 6, 7, and 0 call areas. On the way to the La Paz airport, a few 2 meter tropo and meteor contacts were made.

One highlight of this trip was that Chip worked Bernardo XE2HWB on 6 meters, and this was Bernardo's first contact on 6 meters from his own country. Later Chip and Jack met Bernardo, his family, and Antonio XEHWH. Bernardo operates from La Paz DM44 with 10 watts and a 3-element antenna. Chip and Jack have constructed a beacon for Bernardo, and hopefully it will be operational by the end of July. The beacon will be solar powered and have 1 watt output operating on 50.008 MHz. During the solar eclipse, Bernardo operated as 4B2SOL on 2 and 6 meters.

Stay Tuned!

Next month we'll cover modification of brick oscillators. As always, I will be glad to answer questions relating to VHF/UHF and microwave areas. Please include an SASE for a prompt reply.

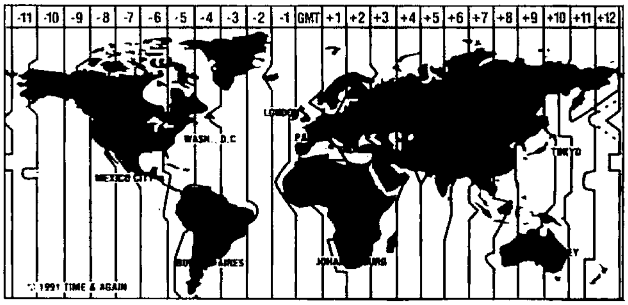
NEW PRODUCTS

Compiled by Linda Reneau KA1UKM

AMERICAN DESIGN COMPONENTS

The 1992 spring catalog of computers and computer-related parts and components at far below OEM prices is now available from American Design Components. Geared to the needs of hobbyists as well as manufacturers, the 54-page catalog features ICs, components, crystals, fans, connectors, batteries, LEDs, switches, power supplies, disk drives, monitors, and much more.

Copies of the catalog are available without charge from *American Design Components, 815 Fairview Ave., Fairview NJ 07022. Tel. (800) 776-3700; (201) 941-5000.*



TIME & AGAIN

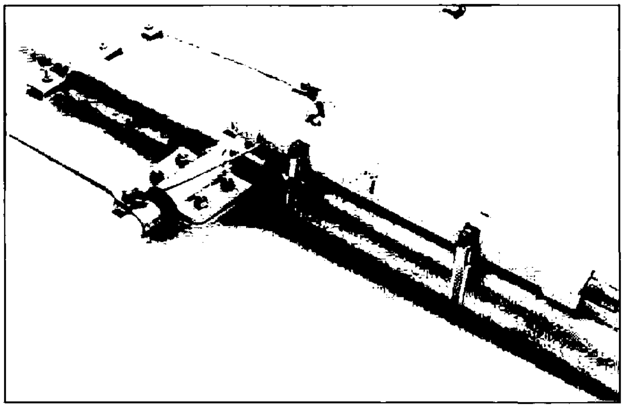
Time & Again Co. is proud to distribute the World Time Zone Map decal, which can be placed on a shortwave receiver or any other object. You can reference international time zones at a glance. These decals are made of a high quality polyester, and are self-adhesive for easy application to any surface. They are attractively toned with silver continents and medium-light blue oceans. The two sizes available provide for accommodation on small areas.

The 2¼" x 4¾" size is $2.00; the 1¼" x 3¾" size is $1.50. You can buy both for $3.00. Prices include tax. Send SASE and payment to: *Time & Again, P.O. Box 306, Dickinson TX 77539.*

MFJ ENTERPRISES, INC.

MFJ's new low pass filter, the MFJ-704, reduces TVI from harmonics and spurious signals generated by your HF rig. It attenuates frequencies above 40 MHz, using a proven 9-pole Chebyshev low pass filter design and MFJ low pass filter technology. The compact 8¾"D x 2¾"W x 3"H filter handles a full 1500 watts of power with low SWR. Insertion loss is less than 0.5 dB. It comes with a one-year guarantee.

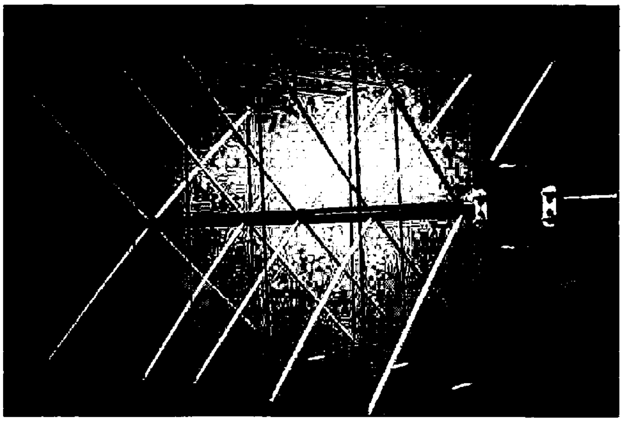
Price, $40. Contact *MFJ Enterprises, Inc., P.O. Box 494, Mississippi State MS 39762. Tel. (601) 323-5869. Fax: (601) 323-6551. Order toll free at (800) 647-1800.* Or circle Reader Service Number 208.



AZTEC RF

Aztec RF now has a deluxe, external ferrite bead-over-coax 1:1 balun. Now recognized as the most effective method of constructing a coreless balun for 160–10 meters, external ferrite beads over Mil-Spec Teflon™ coax ensures reliable choking action for clean radiation patterns and no measurement errors. Teflon UHF or N connector has a shield-hood for full coaxial isolation of current paths. Stainless steel units are epoxy-potted.

Model DXB-1 has eyes for wire antennas; Model DXB-2 mounts on all yagi booms with kit supplied. Each costs $50 plus $4 shipping. *Aztec RF, Box 1625, Valley Center CA 92082. Tel. (619) 751-8610.* Or circle Reader Service No. 205.



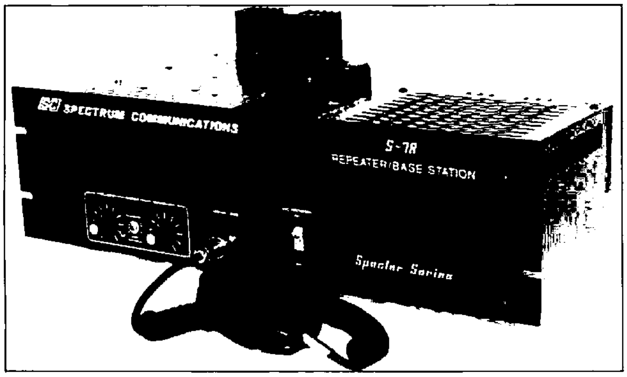
PERFORMANCE ELECTRONICS

Performance Electronics can give you plenty of reasons to own a quad. They offer 2m, 220 MHz, and 440 MHz quads in easily assembled, complete kits. These all-fiberglass antennas have proven, tested designs, a 48" mast, a 60" pre-assembled coax with connector, and are easily stacked for better gain and directivity. Designed to withstand a 40-foot fall, they come with a two-year warranty. Customers receive personal support for operation over the entire legal range and in the respective modes.

Price range, $80–$100. For detailed information, write *Performance Electronics, P.O. Box 310, Conestee SC 29636. (803) 299-1072.* Or circle Reader Service Number 206.

HART PUBLISHING

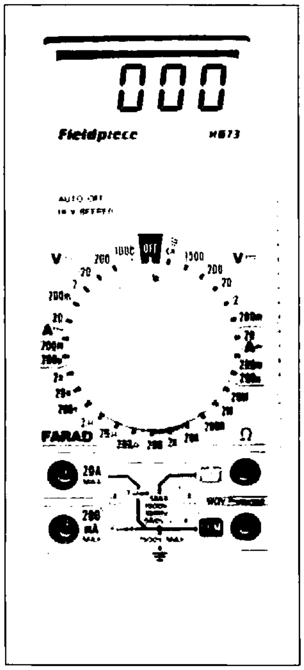
The *1991 Amateur Radio Mail Order Catalog*, published every January and July by Hart Publishing, lists 100 free catalogs along with equipment, businesses, publications, and resources for hams. A single issue is $7, postpaid. A two-issue subscription for this 40–50-page publication is $13. Send your subscription payment to *Hart Publishing, 767 S. Xenon Court, #177, Lakewood CO 80228.* Send also your club's newsletter, or any news and information you think Hart Publishing may be interested in including in their catalog.



COMMUNICATIONS CORP.

Spectrum Communications introduces the new, low cost "Specter" Series S-7R basic repeater/base station. This lightweight but rugged desktop unit also has a 19" rack mounting. The S-7R is available on VHF (10, 30, and 150W), midband, and UHF (10, 40, and 100W), with 100% duty cycle. High sensitivity and selectivity, crystal-controlled, and easy to service, the S-7R can be interfaced to any repeater controller via the proper jack. Numerous accessories are available, such as CW IDer, CTCSS, community tone panel, additional receiver filtering, hand mike, duplexer, cabinet, etc.

Price, $1100. Contact *Spectrum Communications Corp., 1055 W. Germantown Pike, Norristown PA 19403-9616. Tel. (215) 631-1710. Fax: (215) 631-5017.* Or circle Reader Service Number 201.



FIELDPIECE INSTRUMENTS

Fieldpiece Instruments' HB70 Series of heavy duty "book" type digital multimeters are easy to use, with all the capabilities of the meter displayed on the meter's face. These multimeters are built for use in the field. The more control the user wants, the more he may prefer a manual ranging meter instead of an autoranging meter, especially if it's less confusing and easier to use.

Meter prices range from $99 to $179. *Fieldpiece Instruments, 8322B Artesia Blvd., Buena Park CA 90621. Tel. and FAX (714) 992-1239.* Or circle Reader Service No. 204.

MYERS ENGINEERING INTERNATIONAL, INC.

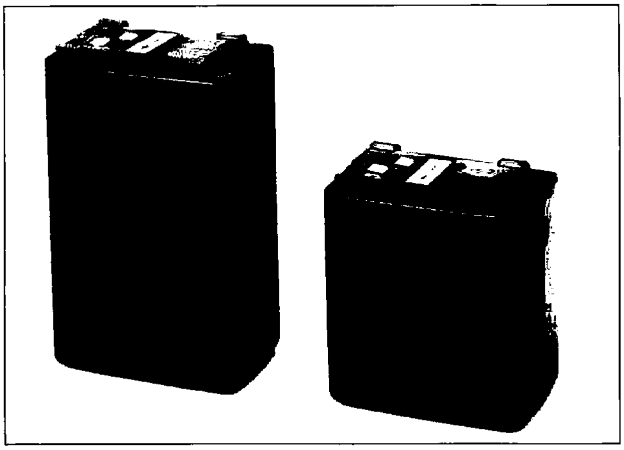
Myers Engineering offers two new yagi beam antennas: the 3-element YL-143-AM for 144–148 MHz, and the 4-element YL-224-AM for 220–225 MHz. Each antenna weighs about three pounds, permits end or center mounting with 50 ohm input impedance, and permits RF input power of 500 watts. Front-to-back ratios are 16 and 20 dB, respectively.

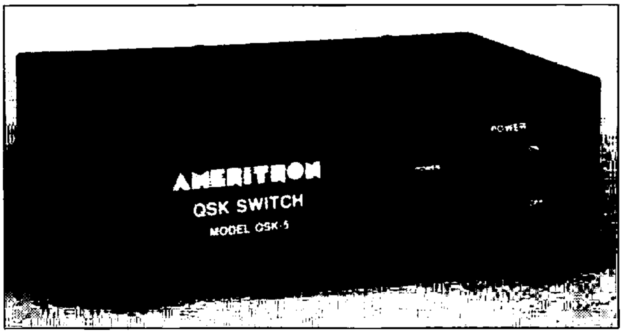
Price per antenna, $85 plus shipping and handling. For detailed specifications, contact *Myers Engineering International, Inc., P.O. Box 15908, Fort Lauderdale FL 33318-5908. Tel. (305) 572-8217; FAX (305) 572-8273.* Or circle Reader Service Number 209.

W & W ASSOCIATES

W & W Associates (Batteries "R" Us) announces the introduction of their replacement batteries for the Alinco DJ-160T/E, DJ-460T/E, and DJ-560/560E. W & W battery part #WC-500-EBP-10N is 7.2V at 700 mA. Battery part #WC-505-EBP-12N, 12V at 700 mA.

The WC-500 is $36; the WC-505 is $49. Contact *W & W Associates (Batteries "R" Us), 29-11 Parsons Blvd., Flushing NY 11354. Tel. (718) 961-2103; (800) 221-0732. Fax: (718) 461-1978.* Or circle Reader Service number 202.





AMERITRON

Ameritron announces the release of the new Ameritron QSK-5 Electronic T/R Switch for linear amplifiers. The QSK-5 gives you switching over six times faster than a vacuum relay, and works with any linear amplifier. The self-contained QSK-5 provides full CW break-in and rapid switching in digital modes as well as faster, quieter switching in SSB. It operates on 120 VAC, handles 2500W PEP and 2000W CW when the SWR is below 1.5:1. It handles 750W on RTTY and packet. An optional cooling fan (CF-5, $40) allows sustained operation at 1500W in any mode.

Price, $349. To locate your nearest Ameritron dealer, contact *Ameritron, 921 Louisville Rd., Starkville MS 39759. Tel. (601) 323-5869; FAX (601) 323-6551; (800) 647-1800.* Or circle Reader Service No. 203.

MIDIAN ELECTRONICS INCORPORATED

Midian Electronics' new ID-1 miniature Morse Code Station Identifier sends a 16-character station ID and/or 130-character message at user-programmable intervals. The ID-1 is easily programmed via a 12-button touchtone style keypad with alphanumeric characters. Other programmable features include front porch delay, code speed, Morse tone frequency, bypass for PTT queing, wait period for loss of COR input, and automatic repeat intervals. If desired, the ID-1 can also send Morse code manually.

The 1.4" x 1.1" x 0.25" ID-1 costs $90. Contact *Midian Electronics Incorporated, 2302 East 22nd St., Tucson AZ 85713-2024. Orders: (800) MIDIANS. Technical Assistance: (602) 884-7981. Fax: (602) 884-0422.* Or circle Reader Service Number 207.

BARTER 'N' BUY

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the *Barter 'n' Buy*, Sue Colbert, Forest Road, Hancock NH 03449 *and get set for the phone calls.*

Deadline for the January classifieds is November 1, 1991.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. A-Z Electronic Repair, 3638 East, Indian School Rd., Phoenix AZ 85018. (602) 956-3024. BNB220

SATELLITE RECEIVERS used, good for experiments. $29.00. Motor controls, $19.00. LNA's $10.00. Satellite Headquarters. (804) 239-7585. BNB231

FOR SALE: HITACHI 35 MHz DUAL TRACE OSCILLOSCOPE. Paid $600, sell $300. Like new. W. Hotine K6HH, 633 Ramona Ave., #23, Los Osos CA 93402. (805) 528-6180. BNB233

WANTED: Yaesu FT-23R-HT and pre-1980 microcomputers for museum. KK4WW. (703) 231-6478/763-3311. BNB234

NEW!! NEW!! NEW!! NEW!! SPEAK TO THE WORLD Amateur radio language guide. •Written especially for the ham radio operator •Hundreds of phrases •Volume 1—Spanish, German, French, Polish, and Japanese. •Volume 2—Swedish, Italian, Portugese, Croatian, and Norwegian •Send $10.00 per book (postage paid). **ROSE**, P.O. Box 796, Mundelein IL 60060-0796. BNB254

CHASSIS, CABINET KITS SASE, K3IWK, 5120 Harmony Grove Rd., Dover PA 17315. BNB259

HOME-BREW PROJECTS lists for S.A.S.E. Kenneth Hand, P.O. Box 708, East Hampton NY 11937. BNB264

QSL CARDS- Look good with top quality printing. Choose standard designs or fully customized cards. Request free brochure, samples (stamps appreciated) from Chester QSLs, 310 Commercial, Dept. A, Emporia KS 66801. FAX (316) 342-4705. BNB434

PL 259, SILVER; TEFLON USA made, 100 pieces, $79.00. Satellite Headquarters. (804) 239-7585. BNB666

ANTENNA PROGRAMS design dipole, inverted-vee, quad; also labels, temp. conversion, guy wire lengths makes it easy to calculate wire lengths; 5.25 360K floppy for IBM compatible. $15.00 plus $3.00 S&H, Emil W8BVR, 6298 Old Allegan Rd., Saugatuck MI 49453. (616) 857-2507. BNB691

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TRANSISTORS RF FOR SALE: MRF454, MRF455, Series Toshiba 2SC2290, 2SC2873, and more. *Looking for repair shops, dealers, and manufacturers.* Call (201) 839-3360. BNB710

FOR SALE: HF STATION Kenwood, Murch, Palomar, MFJ, etc. List, SASE. Jim Stephens WD4LVK, 1184 Lockmiller, Estill Springs TN 37330. BNB712

BEAM HEADINGS: Computed for your QTH using extremely accurate Great Circle method. $7.00, Frank Santillo, P.O. Box 769, Newburgh NY 12550. BNB713

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GIANT SOLAR PANELS $44.00 EAI Excellent prices on solar equipment and accessories. $1.00 for catalog to: Pak Rat Electronics, P.O. Box 690073, Houston TX 77260. (713) 893-0313. BNB715

SIMPLEX REPEATERS $149.00! We manufacture them ourselves. Pak Rat Electronics. (713) 893-0313. BNB716

MANUALS AVAILABLE for all Swan, Cubic/Astro, Siltronix, and Atlas equipment. Send your request to: Brock Publications, P.O. Box 5004, Oceanside CA 92052. (619) 757-0372. BNB717

HAM RADIO REPAIR Experienced, reliable service. Robert Hall Electronics, 1660 McKee Rd., Suite A, San Jose CA 95116. (408) 729-8200. BNB751

WANTED: Ham equipment and other property. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of ham radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Please look over whatever unwanted equipment you may have, and call us. We will pick up or arrange shipping. You will receive the tax deduction, but most important, the privilege of knowing that your gift really made a difference in the education and upbringing of a child. You are invited to check into the WB2JKJ CLASSROOM NET, 1200 UTC on 7.238 MHz, also work the "22 Crew" during our special event operation October 23-25. Write us at: The RC of JHS 22 NYC, INC., P.O. Box 1052, New York NY 10002. Round the clock HOTLINES: Voice (516) 674-4072, FAX (516) 674-9600. BNB762

COMPUTALKER SPEECH SYNTHESIZER PC BOARD $40. Motorola MEX68KECB MC68000 Educational Computer Board, $25 untested. EPROMs 2716/64, etc., Pulled 12/$10. TI 32020 DSP chip and board, $20. Jeff Viola, 475-B Eltone Rd., Jackson NJ 08527. BNB771

WANT SB-313. N7BH. (206) 843-2557. BNB773

"HAMLOG" COMPUTER PROGRAM Full features. 18 modules. Auto-logs, 7-band WAS/DXCC. Apple, IBM, CP/M, KAYPRO, TANDY, CR8 $24.95. 73-KA1AWH, PB 2015, Peabody MA 01960. BNB775

LAMBDA AMATEUR RADIO CLUB International amateur radio club for gay and lesbian hams. On-air skeds, monthly newsletter, and annual gathering at Dayton. (215) 978-LARC. P.O. Box 24810, Philadelphia PA 19130. BNB812

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WANTED: BUY & SELL All types of Electron Tubes. Call toll free 1 (800) 421-9397 or 1 (612) 429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB915

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PRINTED CIRCUIT BOARDS for projects in *73, Ham Radio, QST, ARRL Handbook.* List SASE. FAR Circuits, 18N640 Field Ct., Dundee IL 60118. BNB966

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AZDEN SERVICE by former factory technician. NiCds $36.95 plus shipping. Southern Technologies Amateur Radio, Inc., 10715 SW 190 St. #9, Miami FL 33157. (305) 238-3327. BNB979

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FOR SALE: SCHEMATIC DIAGRAMS for home projects. Write for free list. John Kolozsvari, 3055 Tomken Rd., Unit #304, Mississauga ONT L4Y 3X9 Canada. BNB999

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SPECIAL EVENTS

Ham Doings Around the World

OCT 4

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg., 4600 W. Genesse St. starting at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in on 147.300. Contact ***John Patchett KB2ERJ, (315) 487-0298.*** Please bring two forms of ID and a copy of your license.

OCT 5

GAITHERSBURG, MO A PC Fest Computer Show will be held at the Montgomery County Fairgrounds from 10 AM-4 PM. Admission is $6 for adults, children under 10 admitted free. Sponsored by ***Shows, Inc., PO Box 832049, Delray Beach FL 33483. (407) 241-1660.***

BALDWINSVILLE, NY The Radio Amateurs of Greater Syracuse (RAGS) will hold its 36th Hamfest at the Tri-County Convention Center from 9 AM-4 PM. Flea-Market set-up is 4-10 PM Fri. and 6:30-8:30 AM Sat. All indoors. Wheelchair accessible. Pre-register for VE Exams. For info call ***(315) 469-0590.*** Talk-in on 146.31/.91 MHz.

OCT 5-6

BILOXI, MS The Mississippi Coast ARA, Inc. will hold the ARRL Mississippi State Convention and 15th annual Ham/Swap Fest at Point Cadet Plaza Sat. Oct. 5 from 8 AM-5 PM and Sun. Oct. 6 from 8 AM-2 PM. RV parking. Free admission. VE Exams Sat. & Sun. (Pre-register). Talk-in on 146.13/.73 repeater. Contact ***Charlie Kunz AA5QJ, 6337 Chaucer Dr., Ocean Springs MS 39564-2306. (601) 377-6495 days; (601) 875-9516 eves.***

CHARLOTTE, NC The 40th annual Rock Hill, SC Hamfest/Computerfair will be held at the Charlotte Knights Baseball Stadium Sat. from 9 AM-5 PM; Sun. 9 AM-3 PM. Advance tickets $6 per adult, $7 at the gate, valid both days (parking included). VE Exams (by pre-registration) Sat. at 10 AM. Talk-in on 147.03 (down .600) Rock Hill repeater. For tickets and exam registration, send an SASE and make check payable to ***YCARS, 2129 Squire Rd., Rock Hill SC 29730.***

OCT 6

SPRINGFIELD, OH The Springfield Independent Radio Assn. will hold their 9th annual Hamfest indoors at the Clark County Fairgrounds, Rte. 41, just N of I-70, starting at 8 AM. Sellers admitted at 6 AM. Tickets $4 in advance, $5 at the door. Tables $7 in advance, $8 at the door. Talk-in on 144.85/145.45 and 222.66/224.26. Contact ***Ralph Pamer WA8KSS, (513) 325-1456,*** or SASE to ***SIRA, PO Box 523, Springfield OH 45501.***

HUNTINGTON, IN The Huntington County ARS will sponsor its annual Hamfest at the P.A.L. Club on Riverside Dr., from 8 AM-3 PM. Free parking. Handicap accessible. Set-up at 6 AM. Advance tickets $3.50, $4 at the door. 8' tables $5 each on a first come, first served basis. VE Exams for all classes. Talk-in on 146.085/.685 and 448.975/443.975. Contact ***Jim Covey KC9GX, 1752 Kocher St., Huntington IN 46750.***

YONKERS, NY The Yonkers ARC Ham Fair will be held from 9 AM-3 PM at the Yonkers Municipal Parking Garage, corner of Nepperhan/Main St. Admission $5, under 12 free. Flea Market space $10 per space (bring your own table). Set-up at 8 AM. No advance registration. VE Exams from 12 PM-3 PM at the 1st Precinct Police Station, E. Grassy Sprain Rd. (between Jackson Ave. & Tuckahoe Rd.). Talk-in on 146.865- or 440.15-WB2BNH repeater. Contact ***Y.A.R.C., PO Box 378, Centuck Station, Yonkers NY 10710. (914) 963-1021.***

CHERRY HILL, NJ The Mt. Airy VHF Radio Club, Inc. (The Pack Rats) will sponsor the Hamarama '91 Hamfest from 6 AM-4 PM at the Garden State Park (Rt. 70 & Cornell Ave.). Parking $1; Admission $4; Flea Market space $8. Contact ***Al Boblitt K3EOD, 8389 Langdon St., Philadelphia PA 19152. (215) 742-3312.***

OCT 12

GRAND FORKS, ND The Forx ARC will hold its annual Hamfest at the City Auditorium from 9 AM-5 PM. Talk-in on 146.34/.94. Contact ***John Engel WA0LPV, 616 8th St. SE, E. Grand Forks MN 56721.***

MINDEN, NV The Sierra Intermountain Emergency Radio Assn. will host the Sierra Hamfest/Computer Fair at the Carson Valley Inn on Rte. 395 from 9 AM-3 PM. Commercial spaces $35, individual spaces (if available), $15. General admission $3. Swap Meet will be outside, in front of the RV Park; spaces $5. Contact ***Ed Rogers W6FFT, (702) 266-3661*** or ***Duncan Insley WA6RRU, (702) 267-4223.*** Talk-in: Ask for W6FFT or WA6RRU on 147.330+ MHz.

BROOKLYN PARK, MN The 7th annual Hamfest Minnesota & Computer Expo, sponsored by the Twin Cities FM Club, Hamfest Minnesota and Computer Expo, will take place at Hennepin Technical College, 9000 Brooklyn Blvd. Free parking. Advance tickets $4.50, $6 at the door. The Expo will feature two guest speakers: Robert Locker, Jr. W9KNI, and Carole Perry WB2MGP. Double Decker Fleamarket at $12, $15, $18 per table (depending on location). VE Exams. Talk-in on 146.16/.76 repeater. Contact ***Hamfest Minnesota & Computer Expo, PO Box 5598, Hopkins MN 55343. (612) 535-0637.***

TEANECK, NJ Fairleigh Dickinson University, 1000 River Rd., will be the site of a Hamfest sponsored by the Bergen Amateur Radio Assn. from 8 AM-2 PM. Buyer's admission $2, children free. Sellers $8 per space. Free parking. VE Exams from 8 AM-10 AM, walk-in only; contact ***Pete Adely K2MHP, 13-30 Edward St., Fairlawn NJ 07410. (201) 796-6622 before 10 PM.*** Talk-in on W2AKR 146.790. For info, contact ***Jim Joyce K2ZO, 286 Ridgewood Blvd. No., Westwood NJ 07675. (201) 664-6725.***

OCT 12-13

MEMPHIS, TN MemFest '91-Greater Memphis Amateur Radio/Computer Show, sponsored by the Mid-South ARA, will be held in the Pipkin Bldg. at the Mid-South Fairgrounds. Open Sat. from 9 AM-4 PM; Sun. 9 AM-2 PM. Admission is $5 at the door. VE Exams and forms. Flea Market tables $16 per table for the weekend. Contact ***Steve Cheeseman NX3W, 4880 Cromwell, Memphis TN 38118. (901) 365-6621.*** Talk-in 146.28/.88 and 449.00/444.00.

OCT 13

E. LIMA, OH The Northwest Ohio ARC (NOARC) will hold their annual Hamfest at the Allen County Fairgrounds, Rte. 309; 1½ miles east of I-75. Wheelchair accessible. To register for Exams, send completed 610 and copy of license with check or M.O. for $5.25 to VE Mail to ***W8TY, 1370 Stevick Rd., Lima OH 45807.*** Or phone ***(419) 336-1336.*** Tables are $8 full and $4 half table. Reservations can be made by sending SASE with check or M.O. to ***NOARC, PO Box 211, Lima OH 45801.***

WEST FRIENDSHIP, MD The Columbia ARA, (CARA), will hold a Computer Show, Electronic Expo and Amateur Radio Convention at the Howard County Fair Grounds (off Rte. 144), from 8 AM-3:30 PM. Outside Flea Market/Tailgating space $10 per space; includes 1 general admission. General admission $5 (spouse and children free). 1-4 tables $20 each; 5 or more $18 each (includes 1 vendor admission per table). Contact ***CARA Hamfest Committee, PO Box 911, Columbia MD 21044. (301) 531-2933.***

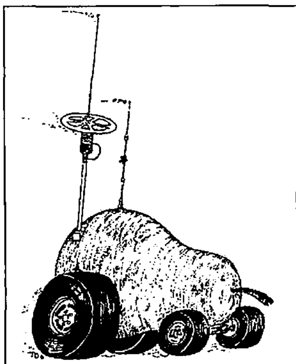
WALL TOWNSHIP, NJ The 4th annual Shore Area Ham/Computerfest, sponsored jointly by the Jersey Shore ARA, Neptune ARSA, Ocean-Monmouth ARC, and the Garden State ARA, will be held at the Allaire Airport, Rte. 34, from 0800-1600. Set-up at 0600. Parking for cars and aircraft. Advance tickets $5, $6 at the gate. XYL's and kids under 12 admitted free. Tables $20, inside hanger with power available. Tailgating spaces $10 each. VE Exams. Talk-in on 145.110 KC2Q, for cars; UNICOM 123.00 MHz, for aircraft. For reservations contact ***Shore Area Hamfest, PO Box 635, Eatontown NJ 07724-0635.*** For info call ***Al Jackson NK2O, (908) 922-8121.***

OCT 19

GRAY, TN The 11th annual Tri-Cities Hamfest, co-sponsored by the Kingsport, Bristol, and Johnson City Radio Clubs, will be held at the Appalachian Fair Grounds located off I-181. RV hookups. Admission $5. Mail inquiries to ***PO Box 3682 CRS, Johnson City TN 37602.***

AUGUSTA, GA The ARC of Augusta GA will sponsor the Augusta Hamfest/Computer Fair at the Augusta-Richmond County Civic Center from 9:30 AM-5 PM. Advance Tickets $4, $5 at the gate. Kids 12 and under free. Dealer tables $10 each plus admission ticket. Set-up starts at 6:30 AM. For reservations contact ***Roy Hillis N4VSN, Rte. 1, Box 58, Girard GA 30426. (912) 569-4261.*** Tailgating space free with admission ticket. WCARS/VEC Exams at 10 AM. For info contact ***Jim Abercrombie N4JA, PO Box 5943, Augusta GA 30906. (404) 790-7802.*** Talk-in on 145.45, alternate 145.49.

COTE ST. LUC, (MONTREAL) QUEBEC, CANADA The Cote St. Luc ARA will sponsor Hamfest '91 at St. Richards Church, 7070 Guelph Rd., from 9 AM-3 PM. Flea Market set-up at 8 AM.



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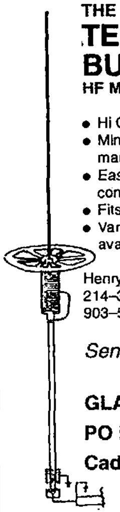

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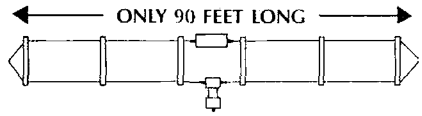

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GARWOOD, NJ The TCRA Hamfest/Flea Market, sponsored by The Tri-County RA, will be held at St. Anne's School on Cedar St. from 8 AM-2 PM. Donation $3, children under 12 (with parent) free. Reservations required for tailgating. Walk-in VE Exams start at 9:30 AM. Bring check for $5.25 payable to "ARRL VEC" (except for Novice Exam), your original license (plus Xerox copy if you want to keep your original), 2 forms of ID, pencils and a pen. Tables $8, $10 with AC. Contact ***Dick Franklin W2EUF, 23 Shawnee Rd., Cranford NJ 07016. (908) 276-6522.*** Talk-in on 147.255/.855 and 146.52.

TACOMA, WA The Radio Club of Tacoma will sponsor its 2nd annual Electronics Flea Market from 9 AM-3 PM at the Camp Murray Armory (exit 122 West, off Interstate 5). Free parking. Overnight parking $2. Admission $3, children under 13 free. VE Testing at 10 AM (walk-ins ok). Talk-in on 147.98/.38. Call ***Ken Moak WA2JQW, (206) 581-6494*** or write to the ***Radio Club of Tacoma, PO Box 11188, Tacoma WA 98411.***

OCT 19-20

EL PASO, TX The International Hamfiesta will be held at the El Maida Shrine Temple Convention Hall, 6331 Alabama St., Sat. from 8 AM-5 PM, and Sun. from 8 AM-3 PM. Tickets $5 in advance, $6 at the door. Tables $5. Tailgate spaces $5 each. VE Exams both days. RV parking. Talk-in on 146.88 repeater. QCWA Breakfast. Contact ***Chris Hines N5LZB, Box 31628, El Paso TX 79931. (915) 584-3824.***

OCT 20

CAMBRIDGE, MA A TAILGATE Electronics, Computer and Amateur Radio FLEA MARKET, co-sponsored by the MIT Electronics Research Society, the MIT Radio Society, and the Harvard Wireless Club, will be held (rain or shine) from 9 AM-2 PM at Albany and Main St. Free off-street parking. Tailgating. Sellers $5 per space in advance, $8 at the gate (includes 1 admission.) Setup at 7 AM. Mail reservations before Oct. 5th to ***W1GSL, PO Box 82 MIT BR., Cambridge MA 02139.*** For info call ***(617) 253-3776.*** Talk-in on 146.52 & 449.725/ 444.725-pl 2A-W1XM repeater.

BENSALEM, PA The Penn Wireless Assn. will sponsor the 3rd annual Tradefest '91 at the Yezzi Athletic Field on Rte. 513 (1 mile south of Rte. 132) from 8 AM-2 PM. Set-up at 6:30 AM. Outdoor tailgating. VE Exams. Admission $3, $7 per carload, kids 12 and under free. Flea Market spaces $5. Premium or multiple spaces guaranteed by advance payment. For advance sales, send checks w/SASE to ***PWA Tradefest '91, PO Box L-734, Langhorne PA 19047.*** Talk-in on 145.25/ -0.6 and 146.52 simplex. Contact ***Steve, (215) 752-1202.***

KALAMAZOO, MI The Southwest Mich ART and the Kalamazoo ARC will co-sponsor the 9th annual Kalamazoo Hamfest at the Kalamazoo Central High School, starting at 8 AM. Set-up at 6 AM. Directions: US 131 to M-43, east to Drake Rd., then north to the school. Free parking. Advance tickets $2, $3 at the door. Tables $1/ft, $4 minimum. Send requests and payment with SASE before Oct. 13 to ***Gary Hazelton KB8PL, 67332 32nd St., Lawton MI 49065.*** Make checks payable to Kalamazoo Hamfest.

CENTRALIA, IL The Centralia Wireless Assn., Inc. and Kaskaskia College R.E.A.C.H. Club will co-sponsor a Hamfest at the Kaskaskia College Gymnasium, Shattuc Rd., beginning at 8 AM. Setup at 7 AM. Free parking. Flea Market space w/1 table, $5. Admission/Main Prize tickets are $2 each or 3/$5. Mail ticket orders with an SASE to ***Centralia Wireless Assn., Inc., Hamfest Tickets, PO Box 1166, Centralia IL 62801*** Talk-in on 147.27/.87 and 443.2/448.2. For info contact ***Bud King WA9U, (618) 532-6606,*** or write to ***CWA, Inc.*** at the above address.

TUCSON, AZ The 4th annual Tucson Hamfest, sponsored by the Old Pueblo Radio Club, will be held at the DeAnza Drive-In, from 7 AM-1 PM. ARCA Meeting. Sellers $4 per space, Buyers $1. Talk-in on 146.22/.82, 146.28/.88, 146.52 simplex. Contact ***A.J. Pawlowski KB7KZ, 3418 W. Green Trees Dr., Tucson AZ 85741. (602) 742-2605.***

OCT 26-27

WEST PALM BEACH, FL The Palm Beach Repeater Assn. will sponsor the Palm Beach County Hamfest Amateur Radio/Computer Show Sat. from 9 AM-5 PM, and Sun. 9 AM-3 PM. at the South Florida Fair Grounds Expo Center. Set-up is Fri. from 2 PM-8 PM. Free parking. RV full-hookup sites. FCC Exams begin at 9 AM both days. Advance tickets $4, $5 at the door. Tickets are valid both days. Flea Market tables are $15 in advance, $17 at the door, if available. Tables valid both days. Talk-in one hour before Hamfest hours and one hour before set-up hours, on 147.165/.765 repeater with 146.520 simplex for close-in work. Contact ***Vi Klekenapp KC4LCF, (407) 585-9074.***

CHATTANOOGA, TN The 13th annual Hamfest Chattanooga Amateur Radio Convention (an ARRL sanctioned Hamfest) and ARRL Delta Division Convention, will be held in the South Hall of the Chattanooga-Hamilton County Convention and Trade Center. ARRL/VEC Exams given both days at 9:30 AM ($5.25). Send 610 form, check or MO, and copy of license with any instant-upgrade info for all exams to ***Bill Wiggins N4BMR, PO Box 23121, Chattanooga TN 37422,*** by Oct. 22nd. Please specify either Sat. or Sun. as desired exam date. No walk-ins. Bring original license and positive ID with you. Flea Market tables are $10 per day, $15 per weekend; electrical power is $25 extra. For Flea Market info call ***Frank Gray KC4TV, (615) 899-7917*** between 6 PM and 10 PM only. Talk-in on 146.19/.79. For Hamfest info write to ***Hamfest Chattanooga, PO Box 3377, Chattanooga TN 37404.*** For exhibitor info call ***Barbarra Gregory WA4RMC, (615) 629-7911*** during work hours, or ***(615) 892-8889*** eves.

OCT 27

SELLERSVILLE, PA The RF Hill ARC will sponsor a Hamfest at the Pennsylvania National Guard Armory, PA Rte. 152, starting at 0800. Set-up at 0600. Admission $4. Talk-in on 145.310, 146.880, 146.520 simplex. VE Exams. Indoor and outdoor Flea Market. Contact ***Bob Buonfiglio WG3X, 361 School House Rd., Souderton PA 18964. (215) 723-1016 eves. 1800-2200.***

MARION, OH The Marion ARC will hold its 16th annual Heart of Ohio Hamfest/Computer Show from 0800-1500 hours at the Marion County Fairgrounds Coliseum. Tickets $3.50 in advance, $4.50 at the door. Tables $7. Talk-in on 146.52 simplex or 147.90/.30 repeater. Contact ***Dan Burns N8JMF, 844 Robinson, Marion OH 43302. (614) 382-2384.***

SPECIAL EVENT STATIONS

NOV 2-3

CHARLOTTE, NC The new Amateur Radio Education Center at the Discovery Place science museum will celebrate its opening by operating from noon (Eastern Time) Nov. 2-noon Nov. 3. The Mecklenburg ARS will operate the station as W4BFB, primarily on phone in the bottom 50 kHz of the General phone subbands on 75, 40 and 20 meters and around 28,400 kHz. For QSL and Certificate, send QSL card and 9x12 SASE with 2 units of first class postage to ***Ralph Eubanks, 6021 Coatbridge Lane, Charlotte NC 28212, USA***

OCT

VERMONT Special Event Stations from Vermont will be operating 25 kHz up from the bottom of the Novice and General bands to help celebrate Vermont's 200th Birthday. RTTY/AMTOR etc. will be in the digital subbands. To obtain a Special Bicentennial Certificate, send $1 and a SASE to ***Amateur Radio Bicentennial Project, PO Box 200, Graniteville VT 05654.*** Foreign stations, send only SAE and IRC's to cover postage.

OCT 5

OZARK, AL The Dale County ARES will operate WD4NXN 1400Z-2300Z to commemorate the annual Claybank Jamboree Arts and Craft Show. Operation will be in the 40, 20 and 15 meter General HF subbands and the Novice 10 meter phone band. For QSL, send contact number and SASE to ***Special Event, WD4NXN, 208 Cherry Lane, Ozark AL 36360-2811.***

OCT 5-6

CAPE COD, MA WB1U will be operating from the Marconi Wireless Station site at South Wellfleet (starting 1400Z) to commemorate its 90th Anniversary (construction started in 1901). Frequencies: General portions of 15, 20, and 40 meters (lower 25 kHz) and the Novice portions of 10 and 80 meters. For Certificate, send QSL and 9x12 SASE to ***Ray Hilson, 6 Sherman Place, Norwalk CT 06851.***

PITTSBURGH, PA The Breezeshooters ARC will operate W3XX from the USS Requin SS481, a Trench Class WWII submarine, from 1400Z-2200Z each day, to celebrate the opening of the Carnegie Science Center. Frequencies: 28.495, 21.365, 14.245. For a QSL card send an SASE to ***WB3LHD, 326 Sunset Dr., Bethel Park PA 15102.***

BRUNSWICK, MD The Brunswick Radio Amateur Groups are planning special event operations for the annual Brunswick Railroad Days Celebration. Brunswick Hams will be signing with location on phone and "/BSWK" on CW from home QTHs and the festival grounds. Frequencies: 28.300/.325 MHz (SSB) in the daytime; 14.250/.265 MHz (SSB), 7.100/.115 MHz (CW) and 3.675/.700 MHz (CW) evenings and overnight, plus local VHF and UHF. For a commemorative photo QSL of Brunswick Museum's Centennial Quilt, send QSL to ***BRAGS, PO Box 143, Brunswick MD 21716.***

OCT 12-13

QUILCENE, WA The West Seattle ARC will operate Station W7AW during the "Quilcene Slug and Oyster DX Festival" from 1600 UTC-0400 UTC Oct. 12 and 1600 UTC-1900 UTC Oct. 13. Frequencies: 7.225, 14.225, 21.125. For a commemorative QSL Certificate showing a friendly slug and oyster at play, send QSL and a large SASE to ***B. Todd, 3719 59th Avenue SW, Seattle WA 98116.***

COLUMBUS, OH The Columbus ARA will operate Station W8TO in conjunction with the Columbus USA Festival, from Oct. 12 at 0000 UTC-2400 UTC Oct. 13. Frequencies: 7.240, 14.340, 21.375, 10m Novice phone band. A commemorative QSL is offered to those who confirm contact with W8TO. A Certificate will be sent to stations who contact at least 10 Columbus area stations. Plaques will be awarded to the two stations making the most contacts. Exchange name, QTH and signal report. Send QSLs and logs to ***Roger Ozwonczyk WB2EIG, 283 East Longview Ave., Columbus OH 43202, USA.***

ROBINS AFB, GA The Middle Georgia RA will operate KN4IE from the Museum of Aviation from 1200Z-2000Z to remember and preserve aviation history on the 44th Anniversary of the breaking of the sound barrier. Airpower or aviation notables may be on the air for this event. Frequencies: (SSB) 3944, 7244, 14244, 21344, 28344; (CW) 3644, 7144, 14144, 21144, and 28244, QRM/QRN permitting. For a unique QSL card and/or certificate signed by World War II Ace and *God is My Co-Pilot* author BGen. Robert L. Scott, Jr., Retired, QSL with SASE to ***Dave Shiplett WL7ACY, PO Box 1076, Warner Robins, GA 31099.***

OCT 18-19

GILMER, TX Hams of Upshur County will operate N5QZK in conjunction with the 54th annual East Texas Yamboree. Operation will be in the General portion of the 40 and 20 meter phone subbands, and in the Novice 10 meter phone subband. For a certificate send QSL and a 9x12 SASE to ***KB5PAD, Rte. 2, Box 114, Diana TX 75640.***

OCT 18-20

UNION, KY The Northern Kentucky ARC will operate K4CO 1400-2100Z from Big Bone Lick State Park in conjunction with the annual Salt Festival. Operation will be on 40, 20, 10 meters, and 147.375+ repeater. For a certificate, send 4x9 SASE and contact number to ***NKARC, PO Box 1062, Covington KY 41091.***

OCT 19

ALCATRAZ ISLAND/PRISON The Sacramento ARC will operate from the Officer's Dining Hall of Alcatraz Prison 1700-2300 UTC. Three transmitters will be on SSB frequencies 7.240, 14.280, 21.350 and 28.350 as best propagation permits. QSL with SASE to ***S.A.R.C., PO Box 162903, Sacramento CA 95816.***

WEST LAFAYETTE, IN The Purdue ARC will operate W9YB from the campus of Purdue University 1400-2200 GMT, to celebrate Homecoming Weekend. Frequencies: 7.280, 14.280, 21.380, and 28.480 MHz (±20 kHz) during the day as propagation and QRM allow. W9YB, located in the West Tower of the Purdue Memorial Union, is open to campus visitors at this event.

OCT 19-20

ATHENS, GA The Athens RC will operate WA4BKF to celebrate Athens' most unusual property owner, the "Tree That Owns Itself." Operation will be in the General portions of the 80-15 bands and Novice 10 meter. For special QSL, send QSL and No. 10 SASE to ***Bill Strickland WA4FVT, 355 Segrest Cir., Athens GA 30605.***

OCT 23-25

NEW YORK CITY, NY The "22 Crew" operating WB2JKJ from the HQ of the Radio Club of JHS 22 will celebrate the 11th anniversary of the Club and their educational program EDUCOM. Join them on 7.238 from 1200-1330 UTC then on to 21.395 till 2000 UTC, Wed. thru Thurs. For an awesome QSL and surprise package, write to ***RC of JHS 22, PO Box 1052, New York NY 10002,*** or FAX it to us at ***(516) 674-9600.***

OCT 31-NOV 1

BREVARD, NC The Transylvania County ARC will operate W4EHV to celebrate Halloween from the Devil's Courthouse in Transylvania County. Operating hours will be from Oct. 31 at 2100Z-0200Z Nov. 1. Frequencies: (SSB) 3.860, 14.295, 21.365, 28.335, 50.150, 144.25; and 146.52 FM Simplex. VHF Packet, KN4GC V NCAVL2.NC. For certificate, send a legal size or 9x12 SASE to ***W4EHV, Erik Hansen, PO Box 10, Sapphire NC 28774.***

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NEW ADDED FEATURES

CIRCLE 160 ON READER SERVICE CARD

Continued from page 46

capacitance, and set both switches to about the center of their ranges.

With the transceiver adjusted for a few watts output on CW, key the transceiver and adjust both wafer switches for the lowest SWR indication. Then, adjust C1 while changing the position of one or both wafer switches, one position at a time, until the SWR is as low as possible. This usually will be 1.1:1 or lower with most installations.

There may be more than one pair of switch positions which produce an SWR below 1.5:1. Although 1.5:1 is satisfactory for all modern transceivers, changing one or both switches a single position one way or the other should allow adjusting C1 for an even lower SWR indication.

Although it may be necessary to change the positions of the wafer switches when going from one end of 80 meters to the other, on the higher bands a slight adjustment of C1 should allow the SWR to be brought back to 1.1:1.

Conclusion

The low-pass antenna tuner is an efficient, wide-range, easy-to-build-and-use accessory for your station. It covers the 3–30 MHz range. It can also be used as an L-circuit tuner to feed random wires as well as low- and high-impedance end-fed antennas. Because it also reduces harmonics by as much as 20 dB, using it properly will endear you to the XYL or OM—and to your neighbors. 73

Contact J. Frank Brumbaugh KB4ZGC at 82 Liddell Street, Buffalo NY 14212-1824.

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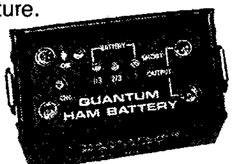

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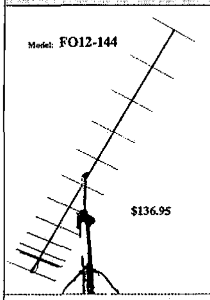

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SWR	1.13:1 typical
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Impedance	50 ohm

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Frequency Specification

Boy, did I open a can of worms a few months ago! Last July I asked for your opinions on specifying RTTY frequencies.

To recap the problem, for those who may have come in late, the question was raised as to whether the mark, the space, or somewhere in between, should be used to specify the frequency of a RTTY signal.

Edwin R. Ranson K5ER of Mustang, Oklahoma, writes: "The question of how to specify an amateur HF digital signal's frequency has been kicked around at least as long as I have been on digital modes, and that's since 1966. Back then, it was pretty standard to specify the mark tone as the operating frequency, but that was before the days of digital readouts and frequency counters becoming so common. We were lucky to know our operating frequency within a kHz (in those days, a kHz was called a 'kc').

"I can tell you how the military and the NTIA (the Federal Government's equivalent of the FCC) specifies frequencies. It is the center frequency of the occupied spectrum. For example, for a voice upper sideband SSB emission, the assigned frequency would be 1.5 kHz above the (suppressed) carrier frequency, since the signal occupies the spectrum between the (suppressed) carrier frequency and the carrier plus the highest modulation frequency. (Voice bandwidth is considered 3.0 kHz wide.) So, if your carrier frequency is 14.300, the assigned operating frequency would be 14.3015. For CW, FM, and AM modes, the center of the occupied spectrum is the carrier frequency, so the assigned frequency and the carrier frequency would be one and the same.

"The same method is used for all emission types, including FSK modes. So, if your mark is on 14.070, that puts your space on 14.06983 (with a 170 Hz shift, with a low space frequency), and your operating frequency is 14.069915. What's the dial read on your transceiver? Depends on the scheme you are using, and, if you have a RTTY mode, the scheme the manufacturer used. Confusing? Not really for channelized operation. Figure it out once, program it in, (or order the right crystal) and you're there.

"But for the way we amateurs operate, that method leaves something to be desired. Personally, I think it makes more sense to specify the mark frequency as the "operating" frequency, because that's something you can measure with a counter. Since there are several different modulation schemes, the standard should be the lowest common denominator. Whatever we use, there should be some sore of standard, so when you want to find the station who said he would be on 14.074, there is an unambiguous understanding of what that number means."

Another opinion was proffered by Kit Kohlmoos W6ISO, whose work we have enjoyed as well in these pages. Kit writes, "I suggest that you consider what the FCC monitoring station will hear [to] determine the answer. When I am setting my frequency close to a band edge, I always calculate the extreme limit of my transmitted sideband in the direction of the band edge, then I set the transmitter frequency so that there is at least a 1 kHz guard band beyond the limits of my signal.

"It's obvious, therefore, that with AFSK the operator should center the indicated frequency about 4 kHz inside the lower band edge if the shift is down, and vice versa if [he's] near the upper band limit and shifting up."

As if not to be outdone, the August 1991 issue of *QST* carries an article on page 28, entitled "What Your Frequency Display Really Tells You." Covering much of what we have brought up, asked about, and speculated upon, this five-page article answers some questions, raises a few more, and fleshes out the topic nicely. It's good reading, and I recommend it to anyone who is interested.

On the flip side, Kit is looking for an "elementary cartridge and interface...to put a C-64 on RTTY, AMTOR, and CW." He's been running a Sinclair ZX81 with software by AF8J and a home-brew interface, but finds it subject to occasional strange tricks which he supposes are due to "RFI, punching the wrong key, or just the whims of nature."

A related question comes from J.R. Popkin-Clurman VE7YT of Ganges, B.C., who is another C-64 owner. He writes that he "... recently acquired a Commodore 64. I have had a Kantronics UTU a number of years, but have never tried to use it until now.

"I would greatly appreciate it if you will tell me how to marry the Commodore 64 and the UTU so I can use it for AMTOR. I am presently on RTTY using a 28KSR with an ST5000."

Segueing into AMTOR, a Mr. Felsenfeld from Yorktown, New York, is looking for some introductory texts and current newsletters on AMTOR.

For all these, I turn the floor open to you all. While I recall a number of simple cartridges and the like for the C-64 in years past, I have no idea if these are still available. A company called Microlog, located here in Maryland, produced one such device. I can find no trace of Micrologat present.

As to texts, I really know of no single source other than those reviewed in this column in the last few years. Readers (and authors) aware of such material are also invited to keep me posted on new developments in the field of published information.

Try a New Band

And finally, a proposal. David Ovad NP2H of Blairstown, New Jersey, writes that, "...in reading 'RTTY Loop' in the August issue of *73*, I find myself in full agreement with William Martin N7EU. I also have found little AMTOR activity on either 30 or 40 meters. I will sometimes call CQ many times on 30 meters especially, only to find no one is on the band. I know the band is open as I use it to log on to NØIA (APLINK) on 10.1405. When I do find a QSO, the other person is as surprised as I am to find activity.

"Maybe we should declare Thanksgiving weekend an HF digital 'Try a New Band' weekend. I say let's give 20 meters a little breathing room. With the sunspot cycle declining, 7 and 10 MHz will become more and more valuable, propagation-wise."

As they say, Dave, "Use it or lose it!" Our dear Wayne has been promoting wider band use for years. Maybe it's about time we listened to him.

More on tap for next month, including more software, and more input from you all. Keep me posted on your digital activities, and let me know what you think of a digital Thanksgiving. Drop me a note at the traditional mail address above, or CompuServe (75036,2501) or Delphi (MARCWA3AJR). I'll be listening!

Number 21 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525-4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or l, or even the number 7. Thank you for your cooperation.

The Commodore/Vic-20 Ham Radio User Group has software for trade. Shareware or public domain ham-radio-related software only. All disks are on 5¼" format. Donations to the library are welcome. Write to *Howard S. Bacon KC4CIQ, 213 Holly Ave., So. Pittsburg TN 37380.*

WANTED: Any kind of HF, UHF, or VHF radio equipment that you no longer need. This is needed to help get a now-defunct high school ham club back on the air. Please help by donating to *Roger Bacon H.S. Ham Club W8MTM, c/o Dan Gettelfinger N8NTL, 8623 Pringle Dr., Cincinnati OH 45231.* Thank you.

NEEDED: Manual/schematic for EICO 369 Sweep Generator. I will pay for the effort. *C. Chadwick N4GTX, PO Box 1381, Palatine IL 60078. (708) 358-3603.*

WANTED: Schematic for Drake Model 2C Receiver. I will pay copying and mailing costs. *Larry Keith KF8BX, 4251 Meadowsweet Dr., Dayton OH 45424. (513) 233-1148.*

My husband is in the Air Force so I am studying for my Novice license while stationed in the Netherlands. I'm a complete beginner and would appreciate a "ham radio pen pal" to help me along. *Mrs. Suzanne Dickerson, 32CSG, PSC 75 Box 1726, APO AE 09719.*

Pastor of small country church desires to communicate with missionaries in Brazil and Mexico, but is on a limited budget. If you have an older HF rig gathering dust, can you help? Contact *Pastor Michael Crowell N5UJA, 4510 FM 1954-Rt. 6, Wichita Falls TX 76301. (817) 322-4606.*

Any MILITARY/DOD active or retired Hams wishing information on operations in Germany, (frequencies, equipment, license requirements, etc.) send SASE to *Robert Dickson Ret., PSC 1 Box R-4988, APO AE 09009-4988.*

Members of the Oregon Region Relay Council continue their drive for funds, to donate a fully operational 2m repeater to the Khabarovsk Amateur Radio operators of the Soviet Union. The Khabarovsk area of the Soviet Union does not currently have any repeaters. Please send donations to *Oregon Region Relay Council Inc., P.O. Box 25451, Portland OR 97225-0451.*

I would like to be in contact with other hams who enjoy on-going role-playing games. If you are interested in joining, write me and let's set up a sked. *Doug Brown KC4RSL, Rt. 4, Box 538, Commerce GA 30529.*

WANTED: A copy of the manual for the Heath SB-630 Station Console. *Bob Schlegel N7BH, 2302 286 St. E., Roy WA 98580.*

I would like to purchase copies of *Popular Electronics* and *Electronics Illustrated* magazines which were published between 1963 and 1983; also schematic/data on a Royce Model I-406 H-T 5W transceiver (manufactured Apr. 1977). Thank you. *R.E. Cassels KA5JTX, P.O. Box 11, Aloka OK 74525.*

I am requesting an operator's manual for the Yaesu FT-209RH 2-meter. I will pay copy and postage costs. Thank you. *Vicente Lopez NP4MZ, 60 Moore St.-5J, Brooklyn NY 11206.*

EROC, the Environmental Radio Operator's Coalition, has started a net on 14.330 MHz every Saturday at 1900Z. The EROC net is designed to promote goodwill between amateurs and to promote environmental awareness through the friendly discussion of topics. This net also handles traffic. Please join us in a cause worthy of amateur radio's use. If you are interested in helping the EROC directly, write the net manager, *Greg Beaver N8LAI, 184 Maplewood Dr., East Lansing MI 48823, or call (517) 351-7785.*

WANTED: Schematics only, for Galaxy GT-550, and/or power supply AC-400 and RV550 VFO. I will pay for copying and postage. *Stephen Brzoska N2MHQ, 27 Willow St., Washington NJ 07882.*

I am requesting an operator's manual for the Yaesu FT-209RH 2 meter. I will pay copy and postage costs. Thank you. *Vincent Lopez NP4MZ, 60 Moore St., 5J, Brooklyn NY 11206*

QRP

Low Power Operation

Mike Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

HW-9 Thump Suppressers

The mail has been running heavy lately since the word has gotten out the HW-9 is no more. Take it from me, if you hear of or get a catalog in the mail from Heath with the HW-9 listed for sale, they're all gone. What units Heath did have were sold at the Dayton Hamvention in no time. If you're lucky enough to have an HW-9, we might as well do a little bit of fix up work on it.

When the HW-9 goes to transmit, the audio line is shorted to ground via Q303, resulting in a rather loud thump. Jack Lau KH6CP has a simple and easy fix to suppress this thump. He just added a JFET in series with the audio line. Instead of grounding the audio, he opens it up. A lot of HW-9s have Zack's thump suppresser installed.

Another version of the thump suppresser comes from Paul Levesque KB1MJ. Instead of using a JFET to open the audio line, Paul used a 4066 CMOS chip (see Figure 1). This chip has several switches inside. By wiring up the different switches, he mutes the audio while at the same time creating an opening in the audio line. This chip also eliminates the thump from the HW-9's audio. See the schematic for more details.

Bandwidth Improvement

Paul has also improved the HW-9's excessive bandwidth. He writes:

"Perhaps the most annoying fault in the Heath HW-9 is its excessive 3 kHz bandwidth and the desensitizing of the receiver via AGC driven by strong signals in the passband.

"I've been quite successful with the 400 Hz, 3-pole crystal filter suggested by Wes Hayward when driven with a high gain FET in order to simplify the required changes. I can now operate on 40 meters at night, a feat found to be impossible with the original design. See Figure 2.

"I have purchased a small quantity of crystals and have matched them very closely in sets of three in order to provide optimum filter performance. Three crystals and the two 680 pF capacitors I have mounted to a small PC board create a 'drop-in replacement' for the original Heath filter FL301. A high gain FET from the J308 family provides a direct substitute for Q301, and increases the IF gain. A small toroidal transformer established the impedance match between the FET and the input of the crystal filter.

"I can provide a limited number of complete parts kits with step-by-step instructions for this conversion to the HW-9 users who are interested in improving the selectivity and AGC function of their transceivers. Keep in mind you'll forfeit the ability to copy SSB with this modification. The cost of the kit is $26. Write me a note if you are interested in more details. Should the demand exceed my supply, orders will be honored in the order received." Write Paul Levesque KB1MJ at 14 Wesley Street, Dedham MA 02026. Don't send your letters to me; route them to Paul for the filter modification.

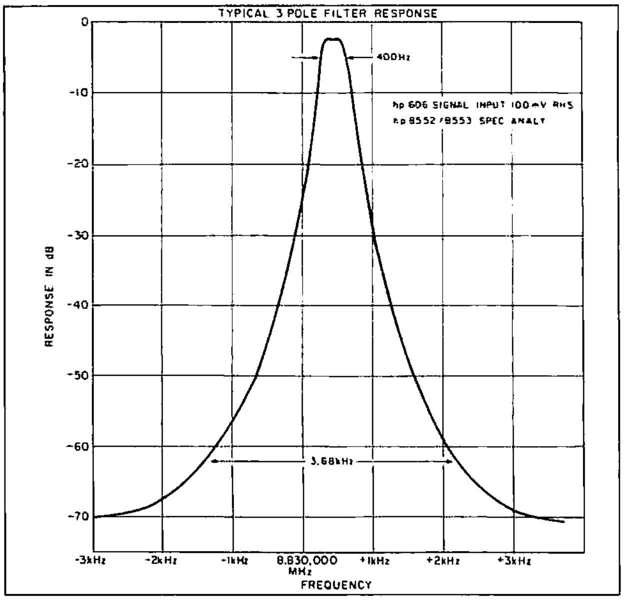


Figure 2. The audio response with the KB1MJ crystal filter circuit.

Calming the Transmitter

I've received several letters and even some phone calls about transmitter instability in the HW-9. There is really no one fix, but rather several fixes that *might* cure the instability. Some HW-9s, like the one I owned, exhibit no instability. I think some cases of instability may be traced back to how the rig was assembled.

When there is instability, it seems to occur mostly on the 15 and 10 meter bands. Adjusting the drive above 3 watts on 10 meters will slam the meter all the way over. This is a good indication of instability. If you have a high SWR on a resonant antenna, but a good SWR into a dummy load, you've got instability problems, too.

Several fixes may help you calm down your HW-9. First, re-solder the PA components as close to the board as possible. Excess lead length will cause problems. Also, change Q402 to a 2N4401 transistor. Since the circuit seems to be quite sensitive to transistor parameters, more than one might have to be tried. In real stubborn cases, try changing C434 to a slightly smaller value. Check the temperature of the PA's heat sinks. If one is really hot, and the other is cold, you might have one dead final transistor. This makes the other one work harder, upsets the design parameters of the PA stage, and results in transmitter instability. Both heat sinks should be comfortably warm after a five minute QSO.

The driver stage, Q404, uses inverse feedback in the form of R414 and C432. To reduce the drive, decrease the value of R414. Go down in small amounts; you don't want to reduce the drive to the point of reducing the power output. These "fixes" should calm down the HW-9's transmitter.

Looking for Trouble

Now, what about the HW-9 that will only put out one watt? Try inserting an ammeter in series with the supply leads. If the input current is excessive, with little RF being produced, your best bet is to start looking at diode D407 for the source of the trouble. If the diode goes bad, almost all of the power from the transmitter goes to transformer T404. Nothing bad happens, but you'll only see a watt or two on any of the bands.

Some of the modifications you may have done to improve the sensitivity of the HW-9's receiver call for replacing the diodes in the front end T/R switching scheme. The diodes are low power Shottky diodes. If you have replaced D407 with the Shottky diode or the recommended HP 5082-2835 diodes, D407 will fail. Diode D407 requires at least a 50 volt rating. There's a lot of RF across it during transmit.

Since Heath has dropped the entire line of ham kits, many of you have written to me, asking for schematics for the HW-7, HW-8, and the HW-9. Heath will still sell you a copy of the HW-7 manual for $17.50. Manuals for the rest of the QRP rigs should also be available. I don't know about parts. Heath tells me they only stock parts for five years after production ends. Call Heath for more details if you're looking for parts.

I have about 200 copies left of the *Hot Water Handbook* (containing modifications for the Heath HW series of rigs). After they're gone, that's it! There'll be no more printed. If you want a copy, send $8.95 to me, Mike Bryce WB8VGE, at the above address.

Since we have covered both the HW-8 and the HW-9, pick up one at the hamfest. They're a lot of fun to fix and modify, and with the days growing shorter, tinkering is especially fun.

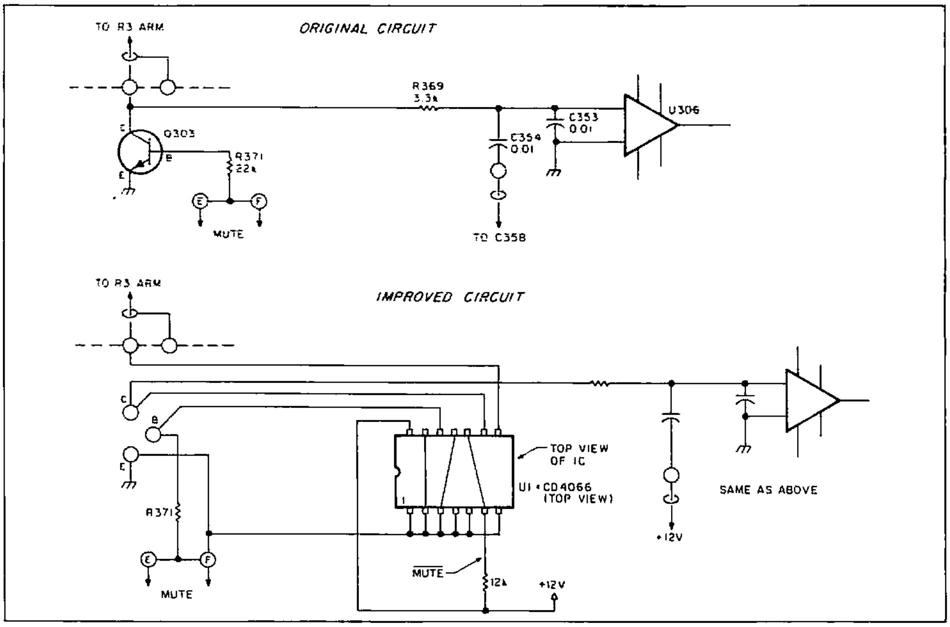


Figure 1. The key-thump suppressor for the HW-9. Courtesy of Paul Levesque KB1MJ.

Never Say Die *Continued from page 4*

the technology of the information age. Yet I feel I'm getting nowhere in helping this desperately needed growth. We're seeing a spurt now as a result of the no-code license, but I had to fight the ARRL for that damned thing for 30 years. Heck, we wouldn't have a Novice license now if it hadn't been for FCC Commissioner George Sterling W1AE jamming it down the ARRL throats.

Once you understand how our American system works, it's easy to make money. Pathetically easy. And, at the same time, you can do things which need to be done to improve the world. I've been working on improving amateur radio and, my ego says, having occasional successes. I'm working to improve the music, the publishing, and the educational businesses.

When you work smart you have time to play too, so it being apple season right now, I'm spending a couple hours a day canning my homemade applesauce. . .the best in the world. You know, I should plant a whole orchard of Golden Transparent apples and go into the business of making this applesauce. There's nothing like it at any price, and it lasts perfectly for years when you freeze it. If you stop by and say hello, I'll give you a taste and completely ruin your acceptance of canned applesauce for life. Hmmm, let's see. . . if each tree will make about 300 quarts every two years. . . .

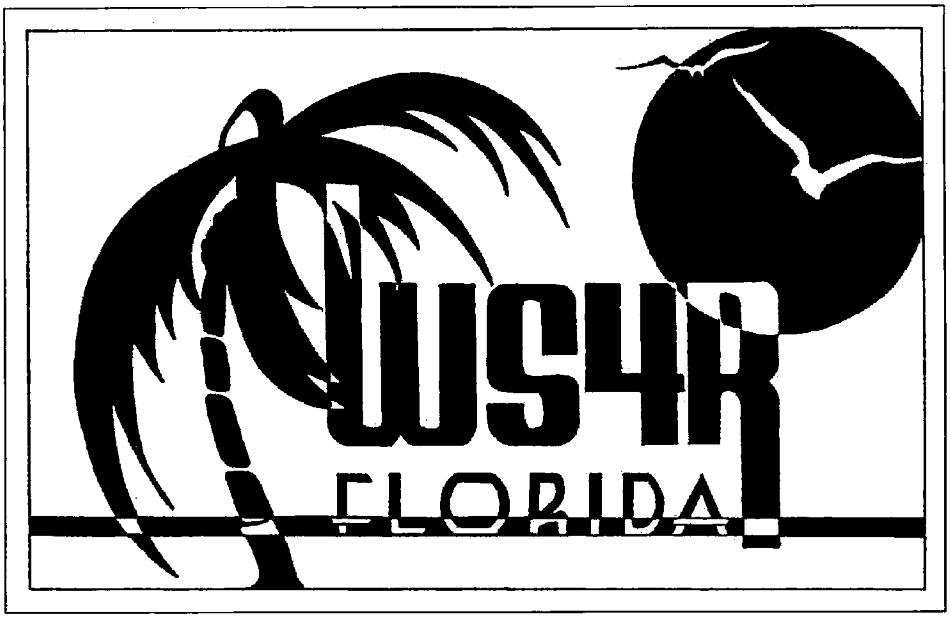
No, I've got to stop coming up with new business ideas. Did I tell you about my "Hurry Curry" business? Probably not, since someone would surely make zillions with it, and all I'd get would be a 1% chance at gratitude. That's a good one to save for my old age.

Tell you what: If you'd like to take off a few days and talk with me about building amateur radio, making money, and such trivia, you're invited to attend the 16th Annual Winter Ham Colloquium in Aspen, February 1–8. We'll ski during the day, HTs in hand, in order to clear our minds for the strenuous evening dinner conferences. Just be there and check in on the local repeater for conference details. Chuck KO1I will lead the expert skiers. I'll be in charge of the aged and infirm who have to stick to the intermediate slopes. Just one more year and I get to ski free!

Shooting The Messenger

Having had a note from a reader about his frustrations in trying to get Bell Helicopters to correct a fault in the wiring harness of a new helicopter, I was interested to find that he'd been laid off. . . and that the V-22 he warned them about crashed on its maiden flight.

In talking with amateurs in government, the military, large corporations and educational institutions, I've found many (most) of them frustrated by poor management and waste. Their frustration eats at them because they hate to see things going wrong, but feel helpless to do anything about it. They know what happens to whistle-blowers, and it isn't pretty.



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

One enormous source of bureaucratic waste, for instance, is the frantic spending of allocated funds at the fiscal year end. Bureaucracies work on the basis of ever-increasing funding. They know if they don't spend everything allocated, their funding will be cut the next year. The people working in these bureaucracies understand the system, but they also hate it. No one likes to see money wasted. . .not even public money. The punishment of whistle-blowers enforces a conspiracy of silence.

I'm sure there were many people who knew what was going on with the savings and loans. . .and many well aware of the BCCI scams. They also saw what happened to the few people who were foolish enough to try and wave the red flag. The lucky ones just got fired.

I suppose you haven't bothered to read P.J. O'Rourke's recent *Parliament of Whores*, so you don't know what a fake the federal budget is, and how Congress is a willing part of this whole scam. (You've also probably heard of Parkinson's Law, but have you ever read his 1957 book? Great stuff!).

P.J. tells us that the emperor has no clothes, that the whole mess is baloney. He makes a solid case. And from the endless horror stories I've heard from hams working in the government and the military, P.J. is not exaggerating. One of the things I recommended as a way to help balance the budget was to set up a federal whistle-blowers protection program. . .perhaps relocating them just as they do helpful criminals. After all, to bureaucrats, whistle-blowers *are* criminals.

If President Bush ever gets more interested in solving our national problems than in curing those of Cyprus, this might be a good starting point. I doubt there is a government agency other than the FCC that wouldn't be enormously improved by cutting its appropriation by 10% per year for the next ten years. That would cut them down to about 35% of what they get today, and it probably would all have to go to pay the generous government pensions. The drop in paperwork alone would allow millions of acres of Canadian forests to regrow.

And The Post Office

While we're cleaning up the mess in Washington, let's lean on congress to take away the monopoly from the post office. That'll put it out of its misery in short order. We might even start exchanging QSL cards again.

Private industry could do an infinitely better job at a fraction of the cost. Oldtimers can remember when we'd contact someone and automatically send them a QSL card. I'm old enough to remember the penny post card. Many of my old QSL cards have 3¢ stamps on them.

There used to be dozens of major QSL card printers. It was a nice business for a retired ham. All it took as a Kelsey press and a classified ad in a ham magazine. I've still got my old press out in the barn somewhere, complete with several large trays of type. Boy, that was fun!

Perhaps it's getting time to build fax modems into our transceivers so we can end contacts with faxed QSLs. We could fill in the "card" on our computers (any kind) with the call, report, and a short message. Anyone up to writing an article on the details? Yep, it'll be black and white for now, but color printers are getting cheaper, so we'll eventually be able to swap full color QSLs. That'll save us about 30¢ on local QSLs and much more on DX QSLs. I can see the day coming when we'll be able to work all continents in ten minutes and have the QSL cards in hand to prove it.

Yes, I hear you old grouches grumbling about the cheats. Look, fogies, we've always had cheats. So what? I've been issuing DX awards for over 35 years, so I've seen the lengths some hams will go to. Weird.

I'm already on record as favoring limiting DX credit just to contest weekends. Then we can ask the rarer DX ops to send in disks with their logs and let a computer sort it all out. We're not worried about the 200 easy countries, just the 200 hard ones. I predict that the ARRL will be set up to handle DXCC disk logs about 12 years after we lose our last DX band.

The Rescue

During the freshman year in many colleges, the fraternities invite you over to meet them. . . and to see if they want you as a pledge. This is called "rushing." I visited a bunch, looking for one where I might fit in. The Dekes had a well-earned reputation for being drunks. The Alphas were snobbish rich kids. . . even had their own bowling alley in their frat house. And so it went until I got rushed by Phi Ep. They seemed more my style, so I pledged.

The freshmen all lived in the freshmen dorms the first year. Then those who didn't make it into a fraternity moved to the upper-class dorms. The students separated into the Greeks and the Geeks.

My prospective fraternity brothers loved the hazing, making life miserable for us pledges. This consisted of making us uncomfortable psychologically and physically. For instance I was given about ten minutes to learn the Greek alphabet, interspersed with a good deal of "assume the position," which was followed by all the batting strength our best ball players could muster. I still know the Greek alphabet.

I suspect that if ham clubs would apply this system to new members to get

them to learn the code we'd solve that problem.

One standard hazing routine was to take the pledges out and get them lost. So about one in the morning one cold snowy night four of us were blindfolded and driven for about a half hour and then two of us were dropped off on a back country road. The car drove off with the other two, leaving us in the snow, with no hint as to which way to walk. There wasn't even a glow in the sky to head for. Worse, there weren't even any other tire tracks in the snow to suggest that more cars might come along. We sighed and started walking.

About five minutes later we saw the lights of an approaching car! At this time of night they'd never stop, but as it zipped by we tried to flag it down. It skidded to a stop and a voice shouted back, "Hey Wayne, is that you?" It was Car-mine Mirenda W2MAM, from the next fraternity down the street from ours.

Carmine dumped out his two pledges and picked us up. It turned out that this was a popular pledge dumping spot. My fellow pledge and I earned an extra beating for getting back to the fraternity house before the brothers who had dumped us. No, we never explained how we did it, but we sure had the laugh on them. Our other two pledges dragged themselves in the next afternoon. If Carmine hadn't recognized me we'd have gotten back around the same time.

Though Phi Ep was in an old beat-up brownstone house in a crummy section of town, and it was about the only non-national fraternity, I didn't mind. I found I'd picked well when the next year we won the intrafraternity sports trophy, the intrafraternity scholarship trophy, and got our president elected the Grand Marshal of the school. We capped that by buying the ex-governor's mansion, moving to the most exclusive part of town, and becoming a Sigma Chi chapter.

I'm afraid my grades didn't help us with the scholarship trophy, and my bowling (195) as third man on the team wasn't a big boost toward the sports trophy, but my modulator powered one heck of a public address system, filling the campus with hi-fi sound and election propaganda.

It had been tough putting up antennas in the brownstone row of houses, but in the new house there was enough room for me to put up *two* 20 meter Twin-Three beams. I worked out like a bandit. I had both a 75m kilowatt (203Zs) and an all-band kilowatt (813s). I put out a humongous signal on all bands. Those homemade W8JK Twin-Three beams were killers.

Alas, Carmine, who weighed in at around 400 pounds, not surprisingly won the coveted Silent Key award while he was still quite young.

Is No-Code Working?

Yep, so far. Looking at the new license figures from the FCC for the February–June period, I see that 1989 went up 2% over 1988, 1990 went up 9%, and 1991 is up 56%. That's a big jump. May was up over 100% from last year. Will it last? The mail I'm getting from clubs around the country is encouraging.

Clubs are reporting substantial increases in their licensing classes. Getting 'em to send me pictures to prove it, is harder than getting 'em to organize group subscriptions to the magazine. Despite almost every family in America having a camera, getting club pictures of ham classes has so far turned out to be a bust.

I'm getting two kinds of letters about no-code. One is from old-timers who are still convinced that no-coders will turn our bands into CB-like messes. The other letters are from readers who have been in contact with these new licensees and are impressed by what good operators they are.

I'm also getting stacks of letters from no-coders thanking me for helping make their license possible. And every one of them has mentioned that now they're working on the code so they can get their Novice and get on 10m . . . and then their General. The letters from the old-timers who are still living in their dream (nightmare) world and who have made no effort to check what's actually happening are in wonderful contrast to the others.

I'm hearing from more and more clubs with license classes filling up. Who knows, this enthusiasm may not be a temporary blip. But we still have a long way to go before we're anywhere near the growth we had from 1946–1964, before the ARRL's "Incentive Licensing" debacle killed the American radio industry.

Now we have an answer for the kids who argue that the code is a useless relic of the past. No problem; get your ticket and join the fun on 2m and up. It gives us a little easier "sell" to youngsters who turn up on CB and find it frustrating.

Has your club appointed some hunters to prowl 11m, looking for new meat? CB is prime hunting ground for potential hams, but you have to catch 'em quick, before they get fed up and quit.

One more thing. Let's not inculcate these newcomers to 2m with the really rotten things some old-timers have almost developed into an art form. Like not answering when a newcomer calls in on the repeater.

Let's see, where was I the other day? Oh yes, New York. I was way up high in the Empire Hotel by Lincoln Center and was able to kerchunk a dozen repeaters. I gave my call and asked if anyone was listening. I got answers on two repeaters. Two! One was in New Jersey. And no, no one was avoiding me. I don't think anyone ever gets my call right the first time . . . and few hams recognize it even when they do finally get it. Maybe 10% put W2NSD and WG together.

Look here, this is a hobby with all of us fraternity brothers, so let's be friendly, helpful and make hamming fun. I really hate it when I need to get word through that I'm going to be late to meet a friend for dinner, only to get refused by hams and have to ask CBers to get help . . . which they cheerfully do. I'll bet I won't get turned down by a no-coder . . . unless some bozo gets to 'em first and louses up their head.

New National Park Proposed

The inside word is that the League directors are considering submitting a proposal to the FCC which would set aside the upper half of the 75m phone band as an Old Hams' Home . . . a retirement community made up of retired hams who are too unskilled, too lazy, or too poor to spend what's left of their unproductive lives playing golf.

Theirs is a force which some directors feel should be harnessed. There's even been talk of establishing special teaching channels along the edge of the Old Hams' Home where they would be able to instruct ham newcomers on proper language . . . with guest lecturers imported from 14,313.

Baxter K1MAN may be asked to prepare tapes for 24-hour-a-day broadcasting on a reserved channel, with endless readings from the current issues of *QST* . . . including all the ads. Baxter's great experience in non-stop broadcasting on the ham bands makes him eminently qualified for this service.

I understand that Dick Bash may be available to teach youngsters how to pass the 20 wpm code test without any knowledge of Morse whatever. And a special channel is proposed for making deals with VECs for mail-order exams so all certifiable Old Hams can get their Extra Class tickets without being overcharged.

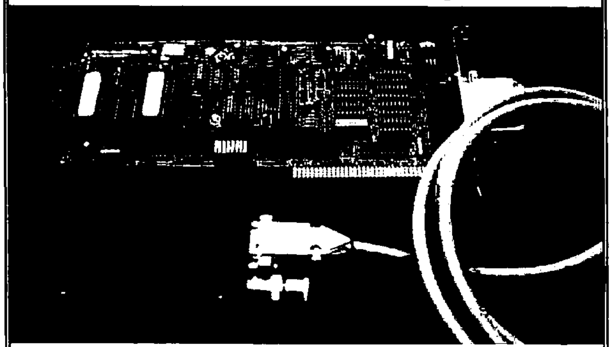
The unfortunate FCC clampdown on the KP4 license mill has forced ticket prices beyond the reach of many old-timers. Extra Class, which used to go for only $100 is now more like $500, which is still a bargain for the top-of-the-line license . . . hassle-free. Advanced seem to be going for around $250. And no, don't bother writing me to find out where to buy your license.

Special net channels and times will be established and enforced for the discussion of no-code, CBers, space cadets, lids, K1MAN, KV4FZ, AM, women, homosexuals, blacks, atheists, Japs, A-rabs, DX lists, contests, net jamming, etc.

Facing reality, the directors are said to be favoring a 10 kW power limit for this National Park Band. Since some of them already qualify to operate in the band, perhaps they don't want to have to operate just with their exciters to be legal. Seems reasonable to me.

Please send your comments to K1ZZ, ARRL, Newington CT 06111 . . with a copy to me. 73

the PackeTwin™ System



The PackeTwin data radio system, with integrated 9600 bps radio modem (G3RUH/K9NG compatible) and a 440 Mhz radio (*antenna* not included).

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More Parts

Last month, we were discussing parts and how to manage them. Let's finish it up:

Keep Chippin' Away

Along with digital chips, analog or "linear" ICs also abound. For instance, most walkies today make use of the LM386 chip for their audio output sections. In some, a "real" LM386 is used, while in others, smaller versions and surface-mount chips with the same internal construction are employed. As with the digital chips, the ammended part numbers may obscure the generic type. For instance, the Kenwood TH-77A dual-band walkie uses the NJM386BM, while the Yaesu FT-411 has the NJM386D. The Kenwood also uses a couple of TC4066BF chips, which are just common 4066B analog switches, although they may be surface-mount mini chips (I haven't opened the rig to find out).

Also found are plenty of op amps. These, too, often have common numbers embedded in their designators. In any case, *any* time you want to replace a chip with one you think is essentially the same, be sure to compare the schematics for the pinouts first. Even if the chips do turn out to be functionally identical, there can be different pinouts, particularly when package types are different.

What Has Three Legs and Amplifies?

While there are lots of chips in our gear, many other semiconductors are used as well. Obviously, one of the most important is the transistor. Perhaps no other category of part has as many types as does the three-legged beast. I can't begin to cover them all here, but I'll try to touch on the major kinds.

Bipolar, or "common," NPN and PNP transistors are still the most often used. They can be found in just about any part of a radio's circuitry, from the front end to the audio amp. Nearly all voltage regulators, RF output stages and discrete audio output amps are made from bipolar transistors. The standard three-legged diagram with the diagonal leads and the arrow is the giveaway. If the arrow points out, the part is NPN; if it points in, it is PNP. What does this mean? It refers to the polarity properties of the internal semiconducting layers, and the shorthand gives you a clue as to which polarities must be applied to make the device turn on. To make an NPN transistor turn on, the base (which is the "P" in NPN) must be positive with respect to the emitter. To turn on a PNP, the base must be negative with respect to the emitter. Note that it doesn't matter what the "actual" polarity (with respect to circuit ground) is; only the emitter is used as a reference. Thus, a PNP transistor can be used in a positive-voltage circuit, with its base being pulled lower (less positive) than its emitter; that's the same thing as negative, as far as the transistor is concerned, and it will turn on.

Oops, I digressed a bit there, but for a reason. If you want to replace a bipolar transistor with one with a different part number (which is very often the case because there are so many kinds, and you can't get many of them), you must first narrow your choice to a part with the same polarity. You just can't replace an NPN with a PNP. By the way, the vast majority of transistors used today are NPN. PNPs, which are harder to make, are used only when really necessary, such as in push-pull (complementary) amplifiers and low-loss voltage regulators.

Besides polarity, the most important specs for bipolar transistors are cutoff frequency, gain, power dissipation and voltage breakdown rating. Whew, that's a lot! This would seem to suggest that it would be impossible to cross a transistor to another part but, in practice, it's done all the time. First, decide what the transistor is doing. If it's in an audio amp and is not part of a complementary pair (in other words, it doesn't have an opposite-polarity transistor connected on top of or below it), chances are that any similar part of similar power-handling characteristics will do the job. If it is part of a pair, you can still replace it with another kind of part as long as you replace its mate with the new part's mate. If you don't, you are likely to wind up with mismatched parts, which will cause signal distortion, uneven current distribution, overheating and premature part failure of either your new part or the old mate.

By the Numbers

A few words about Japanese transistor part numbers: most parts start with either 2N, 2SA, 2SB, 2SC or 2SD. 2SAs and 2SBs are PNP, while 2SCs and 2SDs are NPN. Many techs have been mystified by parts with numbers like "C945." It pays to know that the manufacturers often leave the 2S designator off the part to save space. So, a C945 is actually a 2SC945, which is a very common part. A number which starts with a "3" signifies an FET.

FETs

The FET (Field Effect Transistor) is an entirely different kind of transistor. It uses the "field effect" to regulate electron flow through an internal channel. Its leads have different names: Gate, Source and Drain (instead of Base, Emitter, and Collector).

The gate is analogous to a bipolar part's base, while the drain is like the collector, and the source is like the emitter. In some FETs, the drain and source may be interchanged while, in others, that is not possible. The diagrams look different, too.

In JFETs (junction FETs), the leads all exit straight, not diagonally, and the arrow is in the gate lead in the middle. The arrow points the "other way," too. P-channel FETs have outward-pointing arrows, while N-channel parts have them pointing inward.

In MOSFETs (which have no actual junction between the gate and other leads), the gate is shown as a line separate from and parallel to the one which joins the other leads. No matter what kind of FET you are working with, the important thing to remember is that, as with bipolar parts, you cannot replace a P type with an N type or vice versa. Also, you can't substitute JFETs and MOSFETs for each other.

Power FETs are similar to normal MOSFETs, only they are bigger and can handle much larger amounts of power, just like bipolar power transistors. They have the same basic characteristics as the smaller MOSFETs. They are just starting to find their way into our gear, but they are great parts and seldom fail unless badly overstressed. Their part numbers are very different, and may be something like "IRF511." If in doubt, look at the diagram. Needless to say, you can't replace an FET with a bipolar, or a bipolar with an FET. Their characteristics are just too different.

There are some other, obscure kinds of transistors. One that comes to mind is the unijunction transistor. This thing has a diagram that looks like a bipolar part, except that the base comes in at an angle. Unijunctions are used primarily as pulse generators and oscillators, but they are rare. I haven't seen one for a long time.

Look it Up

A great way to find a transistor substitute that will work is to get a transistor substitution book which lists the "generic" American parts, such as those by GE or RCA. Then, look up the part you want to replace and see what the generic replacement is. Now, look up the part you have available. If it is replaced by the same generic, it will probably work. Even if it isn't, you can look at the specs on the generics and see if they are similar. Beware, though: I have found errors in these books. In a few cases, a large heat-sinked power transistor was crossed to a tiny, milliwatt-level part. In such a case, common sense must prevail; don't try the replacement if you don't like smoke!

Walking on Two Legs

Two-legged semiconductors are usually much easier to substitute. Nearly all the two-legged beasts you will encounter are rectifying diodes. The ones that go bad are usually found in power supplies. In a normal, linear-regulated AC power supply, just about any diode of high enough voltage and current capacity will work fine. A common number would be 1N4002. By the way, those four-legged bridge diodes can be replaced with standard diodes wired to emulate them, again as long as the voltage and current ratings are adequate.

In switching supplies and regulators, high-speed diodes are used and the regular types just won't work. Your substitution book should cover most of these things.

Zener diodes are used as voltage regulating elements. Their diagram looks like that of a diode, except that there are slanted lines exiting from the central one. Zeners operate by breaking down in the reverse direction at a preset voltage. Their essential characteristics are the breakdown or "zener" voltage and the power dissipation capabilities. Nearly all the voltages can be had in generic parts, so it is usually not too hard to substitute zeners.

Small-signal switching diodes typically are of the 1N914 or 1N4148 variety. They are pretty much all interchangeable. Some low-noise switching diodes are used in transceivers, though. If you replace one with a standard diode, it probably will still work, but the circuit's performance may be degraded due to noise generated in the cheaper part. Manufacturers only spend extra for the low-noise diodes when they have to, so it pays to replace such a part with another low-noise one.

Varactor diodes are not really diodes in the rectifying sense, but they have two leads, hence the name. They are really voltage-variable capacitors and should be replaced with exact part numbers or parts with the same capacitance and sensitivity characteristics.

"Hot carrier" and other exotic diodes are sometimes used in mixers and the front ends of receivers, especially in the VHF-and-up range. For correct circuit performance, it is important to replace them with the same types.

Home-brewing

If you're building something from scratch, you may have great leeway in selecting which parts you'll use. In fact, if you have a well-stocked "junk box," you may find yourself designing your circuit to use what you have! This technique can save lots of time and money, but your gadget may not be easily reproducible by others, because those special parts you've been squirreling away since 1957 may have gone out of style. Especially if you want your device published, it pays to use as many standard parts as possible, and to avoid unavailable ones like the plague.

Playing the Standards

So just what constitutes "standard" parts? Well, 2N3904 and 2N3906 transistors are about the most common kind available in the USA. Ditto for 1N914 and 1N4148 switching diodes and 1N4000-series power rectifiers.

If you're designing a digital circuit that doesn't have to operate faster than a few megahertz, consider using 4000-series CMOS parts. They use very little power, do not require regulated power supplies, and are very available. All in all, they are much easier to work with than are TTL and LSTTL chips.

In op amps, the TL-072 and TL-074 are common, as are the 1458 and similar numbers. In voltage regulators, the three-terminal National parts, such as the LM317 and the LM340, are virtual standards.

Well, I promised the addresses of various parts sources but, alas, I'm out of space again. I'll have them all for you next month. See you then.

Number 24 on your Feedback card

RANDOM OUTPUT

David Cassidy N1GPH

Freedom

By the time you read this, things will hopefully have calmed in the Soviet Union. As I write this, the right wing coup is less than 24 hours old. Gorbachev is under house arrest and has yet to surface. Yeltsin is defying the order to vacate his offices, has called for a general strike, and a warrant has been issued for his arrest. Tanks surround the Kremlin, and the world is waiting to see the response from the several republics that have recently tried to declare their independence from the Soviet Union.

As I watch the events in the Soviet Union unfold before me on my television, one word keeps coming to mind: Freedom.

The people of the Soviet Union have, for the first time in their long and tragic history, been served up a small taste from the plate of freedom. Will they be happy with the memory of this brief period of openness, or will they stand up en masse and declare to the power brokers of their society that they refuse to go back to the old ways of repression, fear and dictatorship?

By the time you read this the events will probably have run their course and the outcome will be apparent. For now, watching this giant nation struggle with itself from the comfort of my living room, all I can think of is that one word: Freedom.

Depending on how much of it you have, freedom means different things to different people. It can mean the freedom to speak your mind and criticize the government, without the risk of being thrown in prison. It can mean the right to publish or purchase a copy of Penthouse—or a copy of the Bible (in the U.S., the same article of the constitution covers both). It can mean the right to worship God in your own way, whatever your concept of God happens to be. It can mean the right to work for a fair wage, and that you will not be judged by the color of your skin, the religion you subscribe to, or your gender.

Freedom to a struggling farmer in a third world country may consist solely of being able to provide food and shelter for his family.

Here in the United States, we enjoy an abundant supply of freedom. Our laws of free speech and expression go so far as to allow us to take the symbol of our freedom, the flag, and publicly destroy it in protest. We can stand in front of the residence of our president and shout at him all day long. We can assemble by the hundreds of thousands in front of the Capitol building and express our outrage. Every few years, we have a quiet revolution—it's called election day. Whether it's a senatorial, congressional or presidential election, our system has been set up so that no person can remain in power without the consent of those who bestow that power—the people.

What has all this got to do with amateur radio? Plenty! What do you think it is that gives you the right to tune up on 40 meters and call CQ? What gives you the right to comment on a proposed rule change by the FCC? What gives you the right to tell your congressman that unless he supports a certain bill, he'll be looking for a new job after the next election?

The freedom we exercise every time we fire up the ol' rig is the same freedom that allows some to hang out on 75 meters every night and tell dirty jokes with their friends. The freedom that allows me to trade a recipe for alfredo sauce over packet is the same freedom that allows those screwballs on 14.313 to tie up that end of the 20 meter band with their endless banality, bigotry and bull. Every time we hit that push-to-talk switch, we are taking advantage of freedom.

As we all learned in high school social studies class, freedom carries with it responsibility. Have you ever really pondered what that means to us as amateur radio operators? Every time we transmit, we are giving evidence to how well we are handling the responsibility of some very powerful freedom. Are we exercising that freedom responsibly, thereby guaranteeing it for the next generation, or are we taking advantage of that freedom to serve our own ego?

I'm not advocating that all communication on the amateur bands needs to be dull. I love to get into intelligent discussions of politics and religion, as long as they don't decay into name calling and hurt feelings. I've listened in on—and participated in—some pretty lively QSOs about such topics as the Gulf War, no-code, President Bush's domestic policies (or lack thereof), the recession, the homeless, Islamic fundamentalism . . . the list is endless. Each of these conversations was a heated debate, conducted by people with strongly held ideas and opinions, yet they all respected the responsibility that the freedom of speech demands. They had respect for the fact that they were choosing to exercise their freedom in a public place.

Whenever you transmit on an HF band, there is the likely possibility that you are being monitored by people in several countries. Each of these countries is different, with a different concept of freedom, yet most of these countries have a say in whether or not you and I, as radio amateurs, will be allowed to continue to exercise this freedom via radio waves. Are we showing, by our actions, that the free exchange of ideas, educational opportunities, and international goodwill offered by amateur radio is worth more to a developing nation than a shortwave broadcast allocation?

We do not have a right to the frequencies we occupy. Amateur radio is a privilege, not a right. It is a privilege that we, as a nation, have bestowed upon ourselves. A nation of 250 million has decided to let a group of less than 500,000 occupy some very valuable frequency spectrum. If the nation ever decides that our frequencies could be better utilized by some other service, we will lose those frequencies faster than you can say "majority rules."

Right now, radio amateurs have an enormous amount of freedom. Whether or not we can maintain it is totally up to us and how we exercise that freedom. What's going on in the Soviet Union this hot August night serves to remind us just how fragile that freedom is. 73

Number 25 on your Feedback card

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

October is expected to be a very good month for propagation on short-path, long-path, and intermediate-path distances to DX locations. Although the solar flux continues to slowly decline, with occasional spurts to higher levels, the inexorable reduction in sunspots is going to take its toll.

Early darkness will tend to cause the bands higher than 14 MHz to close shortly before or after dark, while the bands below 14 MHz will begin to come alive for DX. Because of good opportunities for grayline DX (along the path of darkness), you can often make some excellent DX contacts shortly before or after dark and dawn, local time. Morning and afternoon DX will be great, however, from 14–30 MHz.

The best days for propagation will be more numerous than usual, with the really poor days concentrated around the 17th through the 22nd of the month. The appended chart will show you Good (G), Fair (F), and Poor (P) days, and those marked with two letters showing trends toward better or poorer conditions.

Those of you who enjoy DX on top band (160 meters), 80–75 meters, and 40–30 meters, will really enjoy October. During that season, the QRN levels decrease in the Northern Hemispehre due to fewer storms. There are fewer storms because of lower sun angles and less atmospheric heating and vertical mixing. Storm fronts may tend to be slower moving, but the tendency for prolonged high pressure areas to remain over large segments of the U.S. will prevail. VHF/UHFers should be sure to look for tropospheric ducting along weather fronts.

Keep a sharp lookout for some pretty harsh geophysical effects on the days indicated as poor. My guess is that the 18th, 19th, and 20th will be most critical this month. Batten down the hatches on those days, and look for us again in November. See you then. de W1XU 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	—	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	[illegible]
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20	20	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20	—	—	—	[illegible]	[illegible]	20	—	—
U.S.S.R.	20	20	20	20	—	20	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	[illegible]	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20	20	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	[illegible]	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	—	—	20	[illegible]	[illegible]	—	—
U.S.S.R.	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

[illegible]

OCTOBER 1991

SUN	MON	TUE	WED	THU	FRI	SAT
		1 G	2 G	3 G–F	4 F	5 F–G
6 F–G	7 F–G	8 F	9 F–G	10 G	11 G–F	12 G–F
13 G–F	14 G	15 G	16 G–F	17 F–P	18 P	19 P
20 P	21 P	22 P	23 P–F	24 F–G	25 G	26 G
27 G	28 G	29 G	30 G	31 G		

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Issue #374

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Cover photo by Larry Dunn.

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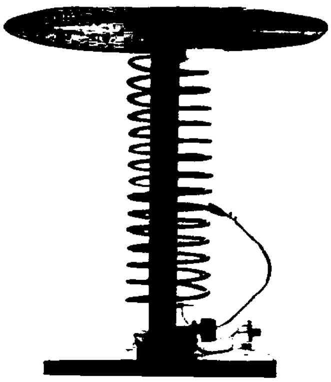

Build a heli-hat antenna. . . see page 32.

DEPARTMENTS

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Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Our Kids vs. Their Kids

If you've been reading *Business Week* you already know how American high school kids compare with the Japanese. It isn't comforting. For starters, the Japanese kids spend 60% more hours in school! And they spend an average of 19 hours a week on their homework, as compared to 3.8 hours for American kids. Is it any wonder they're running circles around us in technology?

If you add the homework and class time and ignore outside reading, it would take American kids 22.3 years to equal 12 years of Japanese education! 10.3 years is quite a handicap. Now, about that reading. . .the Japanese spend almost three times as many hours reading as American kids, so they've got us there too.

Spending more money to solve problems such as increasing the hours kids are in school isn't the whole answer. Forcing them to spend 50% more hours getting a second-rate education doesn't make much sense. Oddly enough, there have been some intelligent studies aimed at finding out what's gone wrong with American education. . .and they've been published. Question: Have you bothered to read any of them?

Yes, sure you love your kids and you hope that somehow they'll do better than other kids. But do you care enough for them to actually take an interest in their education? Not many parents do. Do you care enough for them to try and keep them from getting leukemia by making sure that they're not being exposed to electromagnetic fields. . .either from a nearby power line or pole transformer, an electric blanket, etc.? Do you care enough about their long-term health to not smoke around them?

Are you helping to educate your kids or do you mainly train them not to bother you? The American educational system is a mess, but it's organized in such a way that you have a much better opportunity to do something about it than you might think.

Though education is compulsory, the federal government doesn't control it. It's more in the hands of state governments. . .and those hands are within your reach. . .if you can force yourself to be interested more than momentarily. I don't want to cut into your hamming time or your watching ball games on TV for anything as insignificant as your kid's education. . .upon which the whole rest of his or her life depends.

Like quitting smoking or dieting, it's infinitely easier to put it off than to decide to actually do something. I wrote a little about that a few months ago in "Oh Darn, My Kid's Gone Bad." I think that went in one eyeball and out the other. Maybe if you'll try reading my editorials with one eye shut?

How many hours a week do you read magazines and books which will increase your own knowledge. . .either oriented toward your business or your general education? Sixteen years of school gives you not much more than a foundation from which to start a lifetime of self-education.

I've recently been organizing my library. It's amazing how many books I've read over the last 50 years. Fills 40 six-foot bookcases. . .and that doesn't count another 50 cartons of books out in the barn. Plus two bookcases for cassettes, three for LPs and six for CDs. My house is beginning to fill up with bookcases! Okay, put me down as a braggart, if that makes you feel better, but I brought it up to show that I'm not asking you to do anything that I haven't done.

How do you feel about people who are making more money than you? Is it luck? Or have they worked harder or smarter. . .than you? Are you honestly doing the very best you possibly can at your work? Are you absolutely sure there aren't some books and magazines which might help you do better? How about some courses you might take to help?

And what about amateur radio? Are you trying to learn all you can or are you a glorified CB appliance operator with only a vague understanding of theory? How many of our amateur radio hobbies have you exposed yourself to so far? Each one is a learning experience, and as such can be exciting and rewarding. How well-worn are your ARRL and Radio Handbooks? Tsk!

If you have any kids, have you tried to open their eyes to new ideas and things they can learn? If your kids are over 10, have you interested 'em in amateur radio yet? Kids being naturally contrary, that takes some doing, but it's possible. . .if you're smarter than your kid. Look at it this way: When you want an OSCAR antenna installed on the roof, are you going to have to climb up there or can you con your kid into it?

Making contacts via OSCAR is a blast. It isn't easy, so you know you've done something when you get good at it. Or do you just call in on a 75m round table and that's it? Or fritter away your life adding to the frustrating pile-ups on DX stations?

Been on packet yet? How about RTTY? Do you even know how RTTY works? Okay, how many data bits per RTTY character? How many for ASCII? How about for digital audio? Five, eight, and 16. Can you explain what a parity bit is?

President Bush has been taking some media heat for spending almost all of his time on foreign affairs and ignoring our national problems. He's been much more vocal about getting Turkey and Greece to stop fussing over Cyprus than he has over our educational disaster, our still-escalating drug mess and worsening crime in America. Maybe we need more media event ineffectual task forces.

Even some Democrats have noticed the national leadership vacuum, though few have had the guts to say much about it. And none have come up with any practical solutions to our mounting problems. . .they just carp.

I did get a White House leaked preview of their "America 2000" educational proposal, which has been thrown up in the air for target practice. As proposed, it seems like another delicious pork barrel effort, with $1 million for a school in each congressional district. . .to be used to try and improve the school.

I'm not sure where the government is going to get the needed half billion or why, without some coordination, they expect to see much change in the school system. Considering how the money is going to be distributed, I'm sure our congressmen will find the money somewhere. . .or just go off budget again. We know the money will be gratefully received and happily spent. Perhaps they'll spend it on higher administration salaries. . .at least until it's gone.

Unless this is your first brush with one of my editorials, you know that I don't bring up problems unless I have a proposed solution. And I try to make them creative solutions. So then, how can we turn a half billion dollar pork project into something of lasting value? A silk purse?

Let's put this educational project into a familiar frame of reference so we can deal with it. Let's consider this as an enormous technical research project. Obviously we aren't going to make much progress if we have 535 researchers all going their own way without any communications between them.

Scientists achieve progress through communicating via scientific magazines. They research one aspect of their subject, write a paper that is subjected to peer review and is then published. This tends to weed out the flakes and keep science lurching ahead.

The "America 2000" project would make a whole lot more sense to me if the researchers had a peer review magazine to help tie them together. I've been trying to get Rensselaer Polytechnic Institute to let me help them start such a publication for several years. They've inched ahead, starting a Center for Investigating Undergraduate Education (CIUE), but that isn't likely to accomplish much without a publication dedicated to new educational technologies.

Yes, there's a teeny weeny tinge of self-interest involved. Just by accident it happens that I'm in a good position to provide such a publication at a fraction of the normal cost for starting a new magazine. It wouldn't take a big investment to get it going and into the black. There are hundreds of entrepreneurs out there with innovative products they'd like to have schools know about. Schools will be experimenting with computers, networks, video, audio, card readers and so on. . .and that means zillions of software programs to be evaluated. I think there'd be enough advertising to pay the freight.

With a well-done communications medium I think it would be possible to get good value from the half billion investment. Without it, I smell pork.

Your congressmen and senators are going to be very interested in getting the million for their schools, so it's unlikely there's going to be a great groundswell opposing this bonanza. Write to your representatives and explain that you're going to be watching to see if they spend the money right . . .and that without a communications medium to help guide the participating schools as part of the package the likelihood of anything positive happening is slight.

Sherry says I'm wasting my time since 90% of you don't even have a clue as to who is representing you in Washington. I think she's wrong. . .it's probably 80%. Well, I know my mine. . .like Senator Rudman. And he knows me too. I write him. I visit him when I get to Washington and discuss what's happening.

Our ex-congressman Judd Gregg is now the governor of New Hampshire

Continued on page 74

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Handicap Exemption Clarified

Last December 1990 the FCC changed its policy against code waivers, exempting severely handicapped amateurs from the 13 and 20 wpm Morse code requirements. Recently, the FCC clarified the term "severe handicap" to mean "a disability that extends for more than 365 days after the certification." This announcement comes at a time when some amateurs are thought to be asking for exemptions for handicaps that do not interfere with telegraphy.

The beginning 5 wpm code requirement cannot be waived, since international agreement requires telegraphy knowledge for operation under 30 MHz. However, Volunteer Examiners (VEs) are required to "accommodate" severely handicapped examinees at the 5 wpm level—even to the point of accepting a sending test for code receiving, or just identification of all 43 characters.

The FCC, of course, does not make medical diagnoses. It will exempt disabled amateurs from the higher speed requirements on receipt of a doctor's documentation of the severe handicap. The FCC only permits medical doctors (M.D.s) and Doctors of Osteopathy (D.O.s) to certify an examinee for the waiver. The examinee must sign a release permitting disclosure to the FCC of medical information.

The handicap waiver has generated controversy in many areas. One of the latest has been over the definition of a qualified medical practitioner. The American Optometric Association thinks the FCC's definition is "arbitrary and capricious, and without plausible support in the rulemaking record." The AOA believes that optometrists should be included in the definition, too. The ARRL is concerned that some (nonham) physicians may not appreciate the importance or purpose of the waiver. And David B. Popkin W2CC of Englewood, New Jersey, noted that FCC rules do not require the handicap to be permanent. "A broken writing arm could result in a perfectly legal certification at the time, even though the individual will be cured in a short time." Popkin requested the FCC to issue a uniform criteria to physicians nationwide. In response, the FCC issued two pages of information, Fact Sheet PR-5000 Number 205, and added the 365-day requirement to the rules. The Fact Sheet does not list specific disabilities which qualify for the waiver.

Dennis C. Brown (callsign unknown) argues with the FCC that if demonstration of code skill is necessary to protect the public interest, then it should not be waived for any applicant; but if the public interest does not require proficiency in code, then there is no valid reason to maintain the requirement for any applicant.

Disabled amateurs who are upgrading from General Class are now objecting to having to obtain another original certification from a physician for each upgrade, and they contend that a Certificate of Successful Completion of Examination for Element 1(C) (the 20 wpm requirement) should not be subject to expiration. At present, Part 97.505 rules do not provide for CSCE credit beyond a 365-day limit. TNX *W5YI Report, Vol. 13, Issue #17.*

New IRCs

A new version of the International Reply Coupon (IRC) is now out. The new version states that it is redeemable for the minimum airmail postage to another country. The older version was redeemable for postage equal to the minimum *surface* postage.

In the U.S., post offices should exchange valid IRCs from other countries (stamped on the left) for 50 cents worth of stamps. IRCs continue to sell for 95 cents. In theory, U.S.-issued IRCs can be exchanged for the original purchase price (in the center) minus a one-cent handling charge. In practice, few post offices offer this option. If you run into problems redeeming IRCs, refer your postmaster to section 392 in the International Mail Manual.

If other countries follow the U.S. example, and exchange even the older version IRCs for current air mail postage, the practice of requiring more than a single IRC for return postage of a single QSL card should end. Any DXer who purchases the new version IRC should point out to the DX station that this IRC covers return airmail postage. Any DX station requesting more than one IRC would be charging for QSL cards, a possible violation of DXCC Rule 12(c). TNX *The DX Bulletin, Issue 602.*

PELTS Now Dead

The proposed Personal Emergency Locator Transmitter System (PELTS) had too many problems, the FCC says. The channels held in reserve for PELTS were released to Private Land Mobile Radio Service use last August after the FCC concluded that at this time PELTS could not adequately meet the public need for emergency communication in remote areas. Had PELTS succeeded, it would have used frequencies in the 220–222 MHz band.

In December 1989, in response to a petition filed by Kenneth Seymour KA7OSM, the FCC proposed PELTS for two reasons: emergency rescue and reduction of the illegal use of emergency locator transmitters and emergency location-indicating radio beacons. Seymour, a cellular telephone engineer in Beaverton, Oregon, had originally conceived of modifying the 70 MHz Radio Control Radio Service rules for assisting those in distress in remote areas.

The FCC sought input from organizations and individuals. Fifty parties, consisting of search-and-rescue (SAR) organizations, the Civil Air Patrol, local and state agencies, manufacturers, radio user organizations, and individuals, responded with comments, and eight filed reply comments.

After carefully reviewing the responses, the FCC's decision to reject PELTS was apparently based on two issues: the watch-and-response system for PELTS was not sufficiently developed, which would result in uneven usage and a lack of support for refining the new technology; and the legal trend of pursuing large damage suits would probably discourage individuals and organizations knowledgeable in search and rescue operations from participating in PELTS.

For now, people camping, hiking, mountain climbing, or living in remote areas will have to continue to rely on devices such as smoke flares, strobe lights, signal mirrors, and balloons to alert search-and-rescue teams of distress and the need for emergency intervention. The FCC is looking to the Interagency Committee on Search and Rescue (ICSAR) for guidance on future developments. TNX *Westlink Report, No. 608.*

Earthwinds Balloon

In mid-November, the Earthwinds around-the-world manned balloon flight will be launched from northeastern Ohio. As described in the March '91 ATV column, three balloonists will fly at 35,000 feet in a pressurized capsule as they circle the globe. Captain Larry Newman KB7JGM plans to operate from the balloon on 28.303 MHz throughout the mission. In addition, when he is occupied with other duties, there will be a CW or voice telemetry downlink on this frequency which will periodically relay the balloon's current latitude, longitude, altitude and ground speed. Since this is the same frequency that is used by the CQ All School's Net (the net meets every Tuesday and Thursday at 12:30–1:30 pm Eastern time), it's hoped that schools as well as hams worldwide can have a great time tracking the balloon's progress on its record-breaking non-stop flight.

While over the U.S., there will also be a live TV downlink from the capsule on 434 MHz (fast-scan ATV) as well as a 2m FM signal on 144.340 MHz.

LETTERS

From the Hamshack

Keith Littlejohn via 73 BBS You told us a while back that kids should be able to learn the code at 20 wpm as easy as learning 5 wpm.

We (Kyla N7JVA and I) have five kids, and the three big ones (8, 7, and 5) are getting interested in ham radio and want HF privileges. So where are the 20 wpm tapes for beginners?

This isn't a silly comment! All of the high-speed code tapes are for upgrading from slower speeds, not for starting from scratch.

20 wpm is 20 wpm, so what would be different about a tape for beginners?

As I've written in my editorials every few years, you sit down with a 20 wpm tape and start listening. It's a blur, right? Not quite. If you start listening, you'll hear an E when it goes by. Write down E every time you hear it. Then start listening for T, and write down both E and T as they go by. Next start listening for I, and so on through the alphabet. It's a cinch. In a few hours, you're copying all of the letters, numbers, and punctuation... and at 20 wpm. Beats the hell out of trying to gradually speed up.... Wayne

Jeffrey Viola, Jackson NJ I am a new subscriber to *73 Magazine*, and a wanna-be ham for about 25 years (I'm 36). Probably would have become one as a youngster, but neither my father nor anyone else would take time with a 10-year-old who loved to take apart walkie-talkies, radios, or any other electronic gadget. Over the past two years, I bought the *ARRL Handbook* and every old *QST* I could get my hands on, and have been teaching myself radio electronics. Was gonna go for my Novice (old style) CW ticket, but something held me back... perhaps it was the coma I slipped into listening to the local ham club weekly rag-chew on 2 meters.

When I heard the FCC was going to issue no-code tickets, I jumped for joy! After all, I'm currently employed by a major stock brokerage house as AVP of their communications dept. Talk about technology—we've been sending data via modems at 9,600 bps for a decade. I have one 18 GHz and 23 GHz microwave radios (digital!) linking our headquarters. The 23 GHz radio alone gives me 28 channels, each 1.544 MHz wide! When the big earthquake hit California two years ago, we talked to our people on cellular radiophones. I'm looking into hooking up our SUN workstations on RF or infrared LANS. And "you" wanted me to learn code? Give me a laptop PC hooked to microwave spread-spectrum radio!

The point of my letter is this, however: For all the editorial lip service, *QST*, *73* (yes, *73*), and other publications have given to the new no-code ticket, where are the articles for the potential no-code ham? Other than the one-shot, pat-on-the-back short articles last spring, I have not seen one article. If a computer literate kid picked up this issue of *73*, would he know he could get a ham ticket? I called the local ham club and asked about it, and got less info from them than from a reluctant witness at a Mafia trial....

I personally believe that everyone is afraid that 50 MHz+ will become CB-land. Where are, at least, the UHF articles? Why not get electronics/ham advertisers to put out a special no-code one-time magazine? Charge a few bucks and put it on the racks for one year? And let us know where to sign up to take the no-code??

Jeffrey, we've published quite a few VHF and UHF articles recently. Look for future issues which will show you ways to enter the exciting world of VHF/UHF without breaking the bank. By the way, the magazine you'd like to see is a reality... it's called Radio Fun, *and is now into it's third issue!.... Bill WB8ELK*

Richard Bovee KF8NT, Toledo OH It has been said that along with the influx of the new no-code Technician class amateurs will come new technology. Along with that influx will come new amateur organizations, each striving to be the best they can be, serve their community and better the communications in their area. This, of course, will mean more repeaters. Herein lies the problem: repeater coordination. Good luck! This is exactly the situation we have found ourselves in. We cannot seem to find a 2 meter frequency that can be coordinated. Paging through the repeater directory, I find in some instances, and not to my amazement, more than one repeater per band per individual/club.

Do you suppose the time is near when the FCC should restructure the assignment of repeater frequencies and allow only one frequency pair per band per individual/club?

Jeffrey C. Montgomery WB4WXD, Palestine TX Congratulations on having a fine magazine that attempts to tell it like it is in the amateur community. Mr. Green's columns make life interesting, to say the least, and is the first thing turned to every month. BUT, I have to disagree with a statement made regarding Morse code as it pertained to emergency communications. Mr. Green stated that he was not aware of an emergency situation where code was used in lieu of voice or other modes because of their inability to get through atmospheric conditions. I was personally involved in a situation that proved said value of the code to do just that.

On November 15, 1987, East Texas was hit by several tornados. Our town was particularly hard hit, and lost most of its local and all of its long-distance telephone service. The local ham community swung into action and set up command posts throughout the city. Connection was made to the evening NTs traffic net on 75m using SSB as the primary mode. Because of the static crashes on the air, voice operation was unintelligible. The operators on both ends switched to CW, and although difficult to copy, the traffic did get through that night. The next morning when conditions improved, the traffic was handled on 40m SSB. In all, over 400 pieces of traffic were handled from as far away as Australia. The code proved essential to our operation that first night. We used SSB and packet for the majority of the remaining Health and Welfare traffic.

I am an Extra class ham who has paid his dues to the 20 wpm deity, but I also support the no-code Technician for those who desire to go that route. I've seen some fine, new Techs who are valuable to the service. But I think the reported death of CW is premature. Let's not write off a mode of communication that has proved itself of great value over the years.

Darren Leno WD0EWJ Now that you've piqued my interest in microwaves and all the other things I haven't tried yet, I'd really enjoy seeing more articles on the subject. Take us beyond 10 GHz, and show us where to go to teach ourselves more.

I would also like to see an article that describes the mysterious modes that we hear about but never quite understand, like pulse modulation and spread spectrum. I think many of us don't understand what we are even allowed to do on these high frequencies, let alone how to do it.

Thanks to your badgering, I've become very interested in trying modes that are new to me. I'm saving to buy fast-scan TV equipment, and recently purchased an MFJ digital thingamajiggy so I can learn about ancient modes like AMTOR, RTTY, packet, and stuff. I know I'm 10–30 years behind the times, but better late than never. Moon bounce holds a big fascination for me, and I've been listening to their nets on 20 meters.

Hey, why don't we put a 24 GHz repeater on the moon?

As for your plea to get "good" hams on 20 meters, I went and bought an HF rig just for you. I absolutely cannot believe what I hear on 14.312 (or thereabouts). It makes you want to do something, like tell those guys off. But then, we become part of the problem. So what is the solution? If hams are going to be self-policing, let's give hams some police power.

Darren's Big Solution to the 20 Meter Fiasco: Any ham who has not incurred a violation may become a "Band Monitor" after receiving approval by a full vote of the VEC organizations. If there is any objection by any VEC, that person will not be eligible to become a Band Monitor, but may reapply after one year. There will be no less than 100 Band Monitors and no more than 200.

The specific qualifications for becoming a Band Monitor would be decided later, but this method would prevent any one group from monopolizing the policing function. Band Monitors are responsible for monitoring the bands and issuing "notices" for simple violations. If a ham is a frequent offender, or commits extremely disruptive actions, the Band Monitor complaint is referred to the Hearings Board with the evidence (tape recording).

The Hearings Board is made up of two hams appointed by each VEC. These hams would hear complaints brought by Band Monitors and would have the authority to dish out license suspensions of up to one year. Revocation would be a penalty that only the FCC, on the recommendation of the Hearings Board, would be able to implement.

I think hams need to give themselves some teeth, Wayne. The FCC already makes a provision to listen to the advice of frequency coordinators in disputes arising from repeater interference cases. Why not give the VECs a little more authority to regulate the hams they are licensing?

Howard Pomeroy KA1ZCY, Suffield CT One of the reasons I'm writing is to inform you that I finally passed my Novice CW and theory, and now, Wayne, I am a ham. My callsign is KA1ZCY, and I am so proud of it. My only regret is that my dear Mom and Dad weren't here to share my excitement with me.

73 is a fine journal, my only comment is I wish the "DX" column were a bit larger.

G. Eric Ferguson KA6USJ, Concord CA OK. You've finally done it!! I am now motivated to upgrade from Novice to Tech. I'm your 8th place winner in the Ham-It-Up Sweepstakes. Up till now, I have had many excuses to not upgrade. Lack of money, no place for an antenna, can't remember code, etc., well, you get the idea. Even my Commodore 64 was given to me, and now it's an orphan. I have never been on the air yet, and have had my license for around 10 years. I admit I was hoping to win an HF rig, but I think I'm really going to enjoy the 2m/440 rig. THANKS!!

Fran KG7NZ via 73 BBS I enjoy your magazine immensely. Never stop griping and grousing, it encourages the rest of us to consider other ideas and problems. I also look forward to logging some time on your BBS now that it is up and running.

The new BBS has been up and running full-time since the end of July. Everyone is welcome to browse through the ever-growing list of useful programs you can download. We now have over 1000 users! Feel free to give it a call at (603) 525-4438.... Bill WB8ELK

Voice ID on a Chip

Throw your voice with this versatile circuit.

by Bill Brown WB8ELK

Every so often a device appears on the market that really gets my attention. A company called Information Storage Devices (ISD) recently introduced an IC chip called the ISD1016. This little wonder is the equivalent of a tape recorder on a chip! It eliminates all of the analog-to-digital (and digital-to-analog) circuitry that was required in the past to store and play back voice messages.

One-Chip Voice Storage

This single IC contains a microphone preamplifier, storage circuitry and an audio amplifier. This means that you only need to add a microphone, a speaker and a couple of switches and you have a complete audio recorder and voice identifier. The ISD10XX series utilizes a storage technology similar to that of an EEPROM (Electrically Erasable Programmable Read Only Memory). You may have heard of EPROMs (Erasable Programmable Read Only Memory). You can write data into an EPROM, but it requires a dose of ultraviolet light to erase the memory. Data can be stored into an EEPROM, but it is easily erased with a voltage instead of UV light. This gives you a powerful storage device that can be used over and over again many thousands of times.

The amazing thing about this technology is that the memory is non-volatile. That means that you can remove all power from the IC, even take it out of its socket, and it will retain all of the data stored inside. For example, you could record your voice, set the ISD chip on a shelf for years, plug it back into your playback circuit, and your voice would still be there! One other advantage of this EEPROM technology is that the ISD device samples and stores the actual voltage levels (analog storage) of the recorded audio, resulting in a high-fidelity playback.

Audio Fun

Since most of the complicated digital circuitry is eliminated with this new IC, it's easy to build up some very interesting audio devices. You may have seen those talking key chains with a few canned phrases. Now you can build your own version (although somewhat larger) that talks in your OWN voice. It's quite a lot of fun to put one of these in your pocket, hit the playback button, and watch as people think you're a fantastic ventriloquist. Be careful what you record, it could get you into trouble if you hit the button accidentally! In its simplest form, you can use a voice storage unit as an electronic note pad. You could leave messages for your family and friends, which they could play back later. Add a few switches and a few more components and you have some very powerful audio aids for your hamshack!

Contest Microphone

If you've been in a contest or an event such as Field Day, you know that endlessly repeating *"CQ Field Day, this is..."* can wear you down after a while. Wouldn't it be great to have a device that sent this message out (in your own voice) with the push of a button? How about storing two messages on one chip? A voice identifier which can hold two (or more) additional messages, such as *"You're 5-alpha in New Hampshire,"* would really save those vocal chords. You would only need to speak into the microphone to acknowledge the other station's callsign.

How it Works

The ISD1016 IC chip can record and play back a 16-second message (their new ISD1020 chip can be substituted in the circuit and allows 20 seconds of recording, but at a reduced audio bandwidth). The folks at ISD added digital control to their IC, allowing you to select the starting point address of your message. With the appropriate circuitry, you could divide up this 16-second chip into 160 messages, although they would be only 0.1 second long. For our voice ID, we'll use just two of these address lines to divide our 16-second storage area into two 8-second messages. Note, however, that if you start recording your message at the beginning of the chip, you can use the whole 16 seconds for your message if you so desire.

Your voice is fed into the storage chip via a miniature electret microphone. Toggle switch S3 sets up the voice ID chip to either a record or playback mode. Push-button switch S1 (momentary contact) selects the message start address and activates a 555 timer which brings the 1016's Power Down (PD) and Chip Enable (CE) lines low to start the message number one playback. In a similar manner, switch S2 selects message number two. After each message is played back, pin 25 on the ISD1016 goes low (the end of message signal, or EOM). The voice ID circuit uses this to reset the 555 timer which puts the voice identifier IC into standby mode for extremely low current consumption (3 milliamps when using a voltage regulator, and 150 microamps without the regulator when using a 5 or 6-volt supply). *[Note: If you operate this circuit without the 7805 regulator, do not exceed 6 volts for a power source. If you go this route, substitute a 1N4001 (or equivalent) diode in place of the voltage regulator, as shown in the schematic in Figure 1.]*

To record, switch S3 bypasses the timer circuit and selects the Play/Record input on pin 27. This allows you to activate the ID chip, as long as you hold down on one of the message push-buttons.

The ISD chip was designed to function in a cascaded fashion with a number of ICs in series for extended recording time. When one chip overflows its storage area, it uses the EOM line to turn on the next IC in the cascade. In a single-chip application you need to reset the voice storage device to continue operation if it overflows. This is done by bringing the PD (power down)

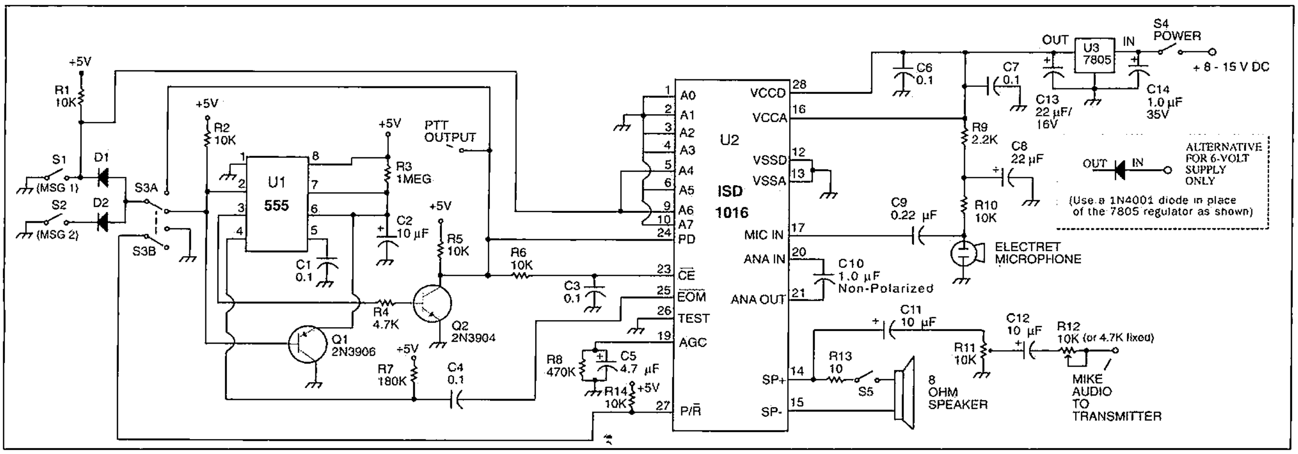
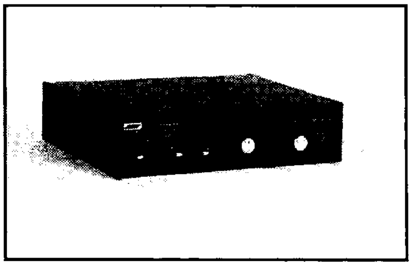


Figure 1. The voice ID schematic diagram.

REVOLUTIONARY

is the only word to describe this:



The NIR-10 is a Noise/QRM Reducer for SSB VOICE! It is the only device available that can reduce noise and remove heterodynes occuring in the presence of speech. What makes this possible? Real-Time Digital Signal Processing (DSP) using a 40 MHz DSP chip!

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line high (which also puts it into the standby mode). The 555 timer IC also functions as a watchdog timer in case the 1016 doesn't get reset properly. If the voice storage chip goes into an overflow condition, the 555 timer will power it down after 20 seconds. Since the current drain is so low in standby, you can leave the voice ID on for long periods without worrying about your battery life.

The ISD chip interfaces directly to a small speaker. Our circuit taps off of the speaker output with two potentiometers, R11 and R12, which lower the audio signal output so that it can be used on your transceiver's microphone input (typically about 20 to 100 millivolts).

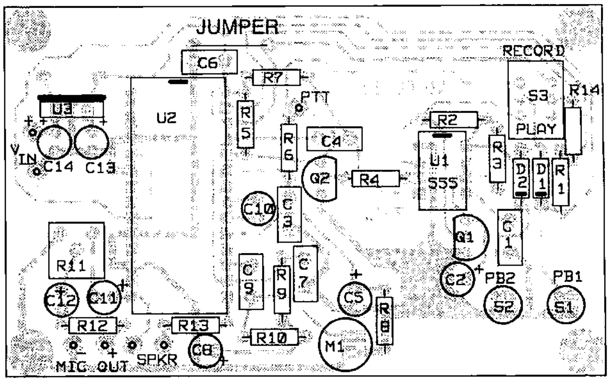

Figure 2. Parts placement overlay (viewed from component side).

Assembly

An etched and drilled printed circuit board (see the Parts List) is available which will make assembly of your voice ID easy. As an alternative, if you're used to breadboarding circuitry, everything should fit on one of the smaller prototype boards from Radio Shack. If you use the PC board, you can attach the push-button switches SI and S2, as well as S3 and the microphone, directly to the board. You only need to wire up a power switch, a battery pack and the speaker. If you want to interface the voice ID to your transceiver, you will have to wire up an appropriate microphone cable (the proper mike diagrams should be listed in your owner's manual). For a contest microphone application, you will have to make up a switch or relay to flip between the voice ID and your regular microphone (you can use the point marked PTT on the PC board and the schematic to trigger an automatic switch or relay when the board is talking). You may also be able to parallel the output of the voice ID across the audio input line on your rig's microphone plug.

If you use a Radio Shack project enclosure, you can mount everything inside (including the battery) to give you one very compact package. If you want to use a 9-volt battery or your shack's 13.8 volt supply, you should wire up the 7805 5-volt regulator (see the parts placement diagram and schematic). Your standby battery drain will be higher since the voltage draws a few milliamps in standby. For the ultimate in miniaturization, I use a tiny 6-volt single cell battery.

Operation

To record your message, just flip the *playback/record* switch to the "record" position, hold one of the *message* buttons down, and talk into the miniature electret microphone. As long as you hold down the *message* button, your voice will be recorded. If you want to record two messages, make sure you don't talk over eight seconds for each segment. Don't worry about filling up the whole eight seconds—the ISD1016 has a built-in *End Of Message* (EOM) indicator that tells it when the end of each message occurs. If you only record for two seconds, your playback will end in exactly two seconds. Note that if you exceed eight seconds for message number one, the EOM signal will not work and you'll run over into message number two. If this happens, you'll just have to try recording again. If you want just one message (up to 16 seconds long), record it into message one and ignore the message two button.

To play back your messages, flip the *playback/record* switch back to the *playback* position and hit the message button of your choice.

When using the audio output to drive your HF or VHF rig, adjust potentiometers R11 and R12 (start out with R12 at the mid-range positon) for the best quality output from your transmitter. If

Continued on page 61

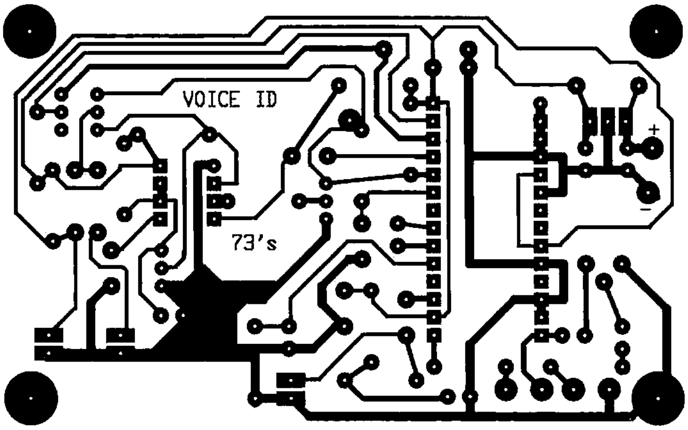

Figure 3. The P.C. board layout for the voice ID (copper foil side).

Portable Frequency Counters

Versatile test equipment that you can really count on.

by Gordon West WB6NOA

Do you own a portable frequency counter? Every ham should have one. Even though you might not do your own internal adjustments to your equipment, a portable frequency counter is a valuable amateur radio accessory.

Here are some everyday ham radio situations where a portable frequency counter can really come in handy. Let's take a look at a typical day in the life of a counter.

RDFing

You can use your portable frequency counter to identify sources of radio frequency interference. This activity is also called radio direction finding, or sniffing. I used mine to pin down the problem of an electric garage door that mysteriously flew open at 5:00 p.m. every afternoon except on the weekends.

The counter registered 151.62500 as the door swung into action, and a quick check up and down the street revealed a utility truck with a high-band antenna on the roof. Sure enough, the driver's "at home, 10-7" transmissions at 5:00 p.m. were the cause of the door energizing. A couple of 0.01 microfarad bypass capacitors on the door opener solved the problem.

With some of the newer counters you can actually read the frequency of a 50 watt VHF mobile signal up to 250 feet away. With lower power HTs you can usually read their frequency from a couple of feet away (sometimes from across the room, depending on the sensitivity of the counter).

Do you own a cordless telephone? Trouble with interference from a neighbor? Since many people now own cordless phones, and there are only about 10 possible frequencies, you can resolve interference problems by first figuring out who's on what channel. Usually the channel number is marked on the phone, but that's the first thing to fall off after the cordless gets a cleaning.

Cordless phones only put out flea-powered signals. The counter is able to count out the transponder frequency, and the handset frequency, when held within a couple of inches of the phone's antenna system. Not only will you read out the precise frequency near 46 MHz or 49 MHz, but you can also tell whether or not your set is putting out the right amount of power. If you can read the frequency to within a couple of inches of the cordless phone's antenna, power output is normal. If you can't read the frequency with the antennas almost touching, your cordless phone probably has low batteries, or low power output. And once you know what frequency your neighbor's cordless phone is on, simply relocate your base unit further away from their particular direction.

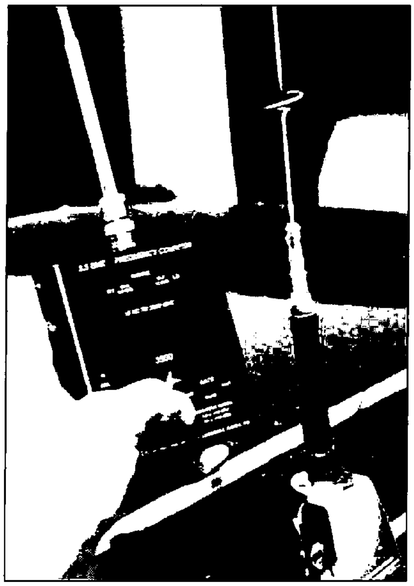

Photo A. To measure the output frequency of your mobile rig just place the counter near the antenna.

Fine-Tune your UHF Station

If you're into 1270 MHz repeaters, 1270 MHz mobile, and HT equipment, a portable counter can really help you fine-tune your sets. You see, equipment at 1270 MHz will many times "age" on frequency, and be as much as 2 or 3 kHz off-channel after a few months of operation. This is because the equipment may use a fundamental crystal still undergoing the aging process. When I checked out my 1282.4 MHz repeater system, I found that the repeater had aged up 3 kHz in just under a year, my handheld had aged down a whopping 6 kHz in six months, and my mobile unit was 2 kHz high.

Placing this equipment back on frequency is easy—hold the counter within a foot of the opened-up equipment, sample the frequency in the slowest rate, and adjust the trimmer capacitor to put the crystal right back on the money. How do you know which trimmer cap to adjust? It's the one usually in the same can as the crystal, and the technical manual for your equipment normally calls out the exact spot on the board. Use an insulated trimmer-cap wand, affectionately known in the land-mobile industry as the "twiddle stick." It's usually yellow with a tiny metal blade. CAUTION—MAKE SURE YOU ARE TURNING THE RIGHT TRIMMER, AND NEVER PRESS DOWN ON THE TRIMMER CAPACITOR. If you fracture the insulating material, you are in big trouble!

Calibrating Your Counter

But how do you know your counter is calibrated? Most counter manuals merely read, "To calibrate the counter, measure a stable signal of known frequency." Hey, wait a

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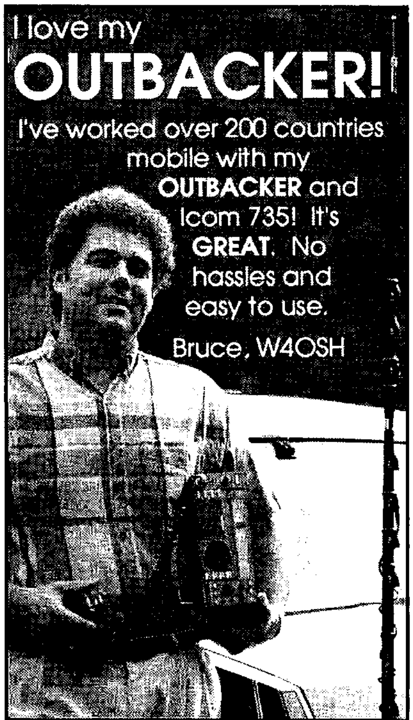

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minute—how do you know that the frequency you are measuring is right on in the first place?

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Resolve your Frequency

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Every ham should own their own counter. I use my counter on almost a daily basis. 73

You may contact Gordon West WB6NOA at 2414 College Drive, Costa Mesa CA 92626.

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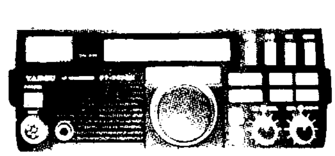

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73 Review *by Dave Buren N2GE*

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Telephone: (213) 639-9000
Price Class: TS-850S, $1700; DSP-100, $630

A versatile HF transceiver with a digital difference.

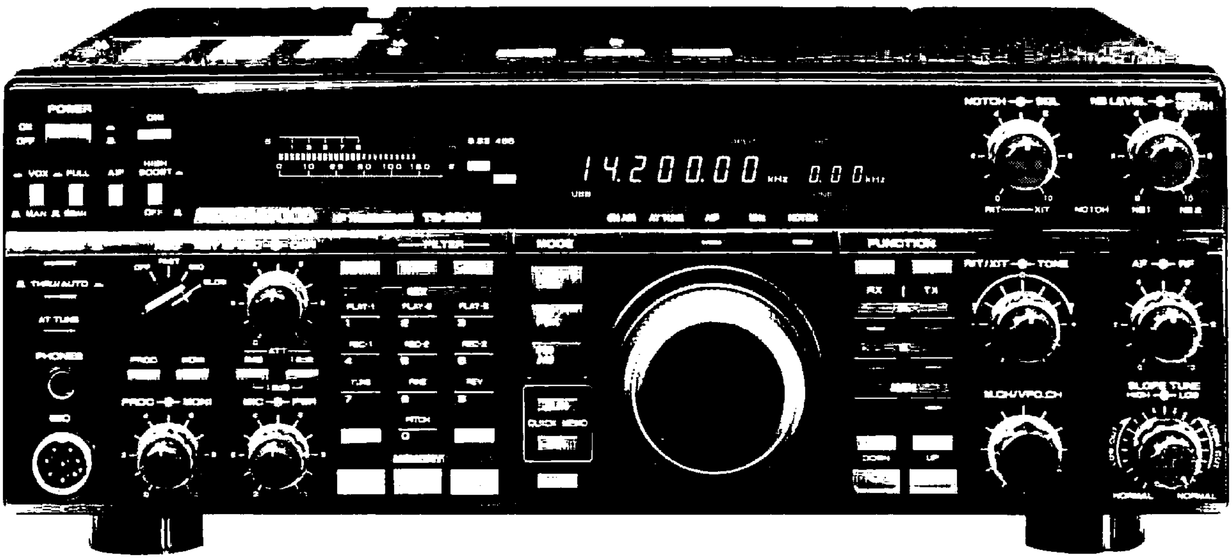

Photo. The Kenwood TS-850S HF transceiver.

Unless you've been holed up somewhere, you must have heard of the TS-850S by now. You might even have worked a few on the air. Let's take a look at the amazing attributes of the TS-850S "Digital Machine."

The Manual

The TS-850 manual is fairly well done. It's long enough (74 pages), but in parts it's a bit tedious (translation warp?), like when you find yourself reading a section two or three times to get the exact meaning. But then, I had intended to read it anyway, eventually. (The DSP-100 instruction manual, on the other hand, is a short six pages.)

The "Specifications" and "Installation" chapters are short and concise. They are followed by "Operations." This is the section that relates the functions and controls, and explains how to actually operate the new equipment. To somebody upgrading from an early '70s rig, like an SB-100, up into the '90s, the next 50 pages is where "the rubber meets the road." I prefer to be sitting in front of the unit, power applied, as I work my way through the text and actually perform each detail and step as I go along. The results of a function or operation are instantaneous, and the act of involving more than just the eye/brain makes it easier to relate and remember.

The sections are divided functionally, with page numbers showing where each block of detailed description begins.

The "Circuit Description" section is actually 10 pages of schematics without text. I'd like to see an in-depth step-by-step description of the inner workings and refinements of a unit's various electronic subsections. I know it is pretty rare these days, but it's invaluable when included.

Features

Let's take a look at some of the unique or noteworthy functions, starting at the upper left of the front panel and proceeding clockwise (see the photo above).

AIP: The Advanced Intercept Point, when actuated, bypasses the first RF amplifier stage with a unity gain stage and, as the manual states, reduces interference from strong nearby signals. Input sensitivity drops about 10 dB and the intercept point refers to the third order input intercept.

HIGH BOOST: This is a tone-shaping switch that increases the high frequency roll-off of the mike amp circuit. I made a check on 75m one night with WB8ELK, who lives about four miles down the road and who knows what my voice sounds like. He reported that it sounded most natural with the boost ON. I've kept it on ever since.

DISPLAY: The display is well laid out and intuitive. There's an incredible amount of information compacted into the seven-square-inch area. I still haven't totally accepted the bar graph meter, but that's the opinion of someone who has five analog meters on his home-brew linear amplifier. The bar graph is an S-meter in receive, and indicates power and a choice of SWR, ALC or compression in transmit. It has 30 dis-

crete segments and will hold the peak reading for about a second (if you select the peak-hold function in the soft menu).

NOISE BLANKER: There are two. NB1 is designed for short duration noise, such as ignition noise; NB2 is for longer duration noise, such as the "woodpecker" over-the-horizon radar.

SLOPE TUNE: You may know how it works, but maybe not how well. In a pile-up you've got to have the optional 1.8 kHz SSB filter, but for the average QSO where suddenly a nearby (1.5 kHz or so) signal pops up, the high cut slope tune really works nicely. High frequency QRM can be totally eliminated without changing the audio quality of the desired signal whatsoever. I'd find myself swinging the cut knob in and out again to see if the adjacent station was still transmitting. He was. The low cut works equally as well (in USB). Totally effective!

M.CH/VFO.CH: This dual-function knob is linked to a 24-position optical shaft encoder. In memory mode it quickly scrolls through the 100 channels of memory. In VFO mode it will step the frequency through in user-programmed steps of 10, 5 or 1 kHz, from the top to the bottom of the band, in less than two quick turns of the knob.

QUICK MEMO: There are five FIFO-type scroll memories which store all set-up and frequency information (receive/transmit frequency, modes, filters, meter selections, antenna tuner setting, etc.) in a stacked fashion. As new frequencies are stored, the oldest (or first) is shoved off the register. This is extremely useful for a scratch pad of activity on a band, and instant recall to any of the five "memos" takes just one keystroke.

FUNCTION: The selection of RX/TX split frequencies for a particular VFO or memory is extremely clear and intuitive. Each push-button is LED-backlit, so you can see the status at a glance.

KEYPAD: This 12-button keypad functions as a direct frequency entry and doubles as a control for the following additional functions: record and playback of the three tracks of the optional DRU-2 digital voice recorder; FINE tuning at a rate of 1 kHz per revolution (it feels almost like an analog VFO); TUNE, which puts out half-power in XMIT and enables zero-beat without carrier in CW; REVerse, which toggles to the opposite sideband in CW receive and XMIT; and PITCH, which selects the tone of the received CW signal.

Digital Signal Processing

The function of any DSP system can be described as follows: The signal is acquired and converted to digital form via an ADC (analog to digital converter), the digitized data is processed by simple fast algorithms, and the results are converted back into a usable form via a DAC (digital-to-analog converter) or stored in memory. The foundation of DSP is Shannon's sampling theorem (you may have heard it before, but here it comes again) which states that a signal must be sampled at a rate that is at least twice as high as the highest frequency in the signal's spectrum.

DSPs are characterized by a small address space, a small specialized instruction set, limited addressing modes, separate data and program paths and, most importantly, a single cycle execution of instructions. General purpose microprocessors are microcoded, meaning that each machine instruction (neunomic) executes an internal "micro" program within the CPU. These neumonics are hardwire-decoded within the processor. This conserves silicon (less costly) and yields a functionally generic microcircuit whose process is dependent upon the microcode. This is what put Intel into the "Fortune 500,"...that little 4004 started it all. Unfortunately, microcoding increases instruction execution time, using multiple internal clock cycles for each instruction. On an 8051, for instance, an External Data Memory bus cycle consists of 12 clock cycles, or T-states, just to fetch data located in off-chip memory. An instruction execution can consume anywhere from 500 ns to hundreds of microseconds. A DSP executes instructions, including the all-important multiply and shift instruction in a single 25 ns to 200 ns operation.

Microprocessors have a single memory used for both data and instructions. They are referred to as Von Neuman Machines. DSPs are Harvard Machines, i.e., they have separate data and program memory (and busses). This feature allows them to simultaneously fetch an instruction and data operand and perform the specified operation at the same time. The Motorola 56000 has two distinct data memories and can operate on both of them in a single cycle. Data memory to a DSP is equivalent to a large bank of general purpose data registers like those found in a standard processor, and can be used in similar ways. DSPs have been optimized to execute a sum-of-products function of the form $A=B\bullet C+D\bullet E+F\bullet G+....+X\bullet Y$. Notice that this is the basic element of a digital filter!

A microprocessor has a problem executing binary, fixed-point arithmetic. When a value overflows a register, it "wraps" around, going from positive to negative or vice-versa. The maximum value can be anticipated, or the calculation can constantly be sampled for overflow, requiring the register to be reset if necessary. DSPs on the other hand have a built-in facility to curb this problem. There is a barrel shifter (a large shift register with the output of the last stage fed back to the input of the first stage) built into the ALU that allows a binary number to be shifted any number of bits in a single cycle. Thus, you can multiply or divide by any power of two in the same cycle. Using multiply and accumulate instructions, the accumulator can be shifted in the same instruction before the result is stored. This allows the binary point of the arithmetic to be moved with little effort. Crunch, crunch crunch!

The DSP Interface

The introduction of the DSP-100 represents one of the first applications of this new technology in a commercial communications receiver, but the effort falls a bit short. The instruction manual states: "Since the processing is done at an IF level, it results in a more copyable signal. Not only are you able to tailor the audio frequency response, but because the signal has been digitally processed it also appears to be cleaner or more crisp." I searched to find the situation where this was so, because this new technology is truly exciting and veritably budding with new and tremendous potential. Under a myriad of different operating conditions and bands and times of day, the unit did not perform any better than the excellent selectivity and interference rejection capabilities of the IF slope tuning of the basic TS-850S.

One of the problems inherent to the design is that the filter switches have only four discrete positions, and the span of the selection is much too limited. The LPF (low pass filter) switch selects 100, 200, 300, and 400 Hz as the roll-off frequency, and that's it. Likewise, the HPF selects 2600 to 3100 Hz in four steps. Technically, it wouldn't be unfeasible for the upper and lower skirts to extend far enough to overlap, and thus comprise an agile digital notch with very precise width and form factors. In the transmit mode I simply had to take Kenwood's word for the purported improvement in suppression of the unwanted sideband. I performed numerous air checks with and without the DSP and most hams could detect no difference.

In CW TX mode, the rise and fall times are adjustable in steps of 2 ms from 2 to 8 ms, presumably to give a softer sounding signal. The difference was evident on the SM220 Monitorscope. The rise time was precisely as it should be, with no overshoot.

Impressions

Twelve volt operation is really a plus! The ability to stay prepared to assist in an emergency is as important a function of our hobby as any other single facet. We should be thinking more about deep-discharge batteries, windchargers and solar panels, and kick the power grid habit.

The power-on-function-selection is one of my favorite features. With one finger, press and hold the USB/LSB key while pushing on the power button. You are into a mode that allows for the customizing of 34 different functions. From sub-tones (burst or continuous) to (bug or iambic keyer) to (RIT range of ± 1.27 or 2.54 kHz) to (FSK shift of 170 to 850 Hz) to (10 Hz display resolution ON/OFF), etc. The values are set once and held in non-volatile RAM. Remove power and power up again and the values will be in effect.

Shortwave listening (SWLing) is very easy with the TS-850S. One of the programmable functions just described allows for the selection of the step rate (10 kHz/5 kHz/1 kHz) of the 24-position VFO channel knob. If you set the width to 5 kHz, the rig will step exactly to the assigned channels of the SW broadcast

bands, thus effectively channelizing precisely. It couldn't be easier. With a tone control knob and plenty of excellent audio, SWLing became one of my favorite program sources when working on projects in the shack or pounding the Mac. I had a surprising renewal of interest in BBC, DeucheWelle, Radio Moscow, etc., and with 100 memories, there's plenty of room to store some prime frequencies.

I really have to stretch a bit to think of anything very negative to say about the TS-850S. I didn't like the RIT span limitations and the fact that it wouldn't reset when returned to later. The potentiometer retains rotation memory (with no center detent). Also, there was not a direct line-level connection from the digital voice recorder to the audio line, except by acoustic coupling (mike up to the speaker).

The automatic antenna tuner is fast and accurate, with very little overshoot or hunting, and the full CW break-in was extremely quick. It was a new experience for me to have it be that quick, and a bit distracting to hear the band condition between dots. When someone would start transmitting nearby while I was sending, I had to knuckle down and really concentratel

My overall feeling about the TS850S was very, very positive.

There's a function on my decade-old TS-180 which should be in this receiver: frequency difference, between VFO and selected memory. This makes it possible to search for a clear frequency when trying to QSY, and then pop back on frequency and report "up 4.6 kHz," since it is displayed in readout.

The DSP-100 interface heralds the exciting future of digital signal processing into amateur radio and we should be glad to see its arrival. It will be exciting to see what the next generation will be like. I bet it won't be long, 'cause we "ain't seen nuttin yet." 73

TS-850S Specifications

GENERAL	Transmitter frequency range	160, 80, 40, 30, 20, 17, 15, 12, 10 meters
	Receiver frequency range	100 kHz–30 MHz
	Mode	A3J [J3E] (USB LSB), A1 [A1A] (CW), F1 [F1D] (FSK), F3 [F3E] (FM), A3 [A3E] (AM)
	Antenna impedance	50Ω
	Power requirement	13.8 VDC ±15%
	Power consumption	Max transmit 20.5 A; receive (no signal) 2 A
	Dimensions	13"W x 4.7" H x 13" D
	Weight	11 kg (24.25 lbs.) approx.
TRANSMITTER	Final power output	SSB/CW/FM/FSK—100W, AM—40W
	Modulation	SSB—Balanced modulation FM—Reactance modulation AM—Low level modulation
	FM maximum frequency deviation	±5 kHz
	Carrier suppression	Less than −40 dB (Modulation frequency 1.5 kHz)
	Spurious response	Less than −60 dB (CW)
	Unwanted sideband suppression	Better than 40 dB (Modulation frequency 1.5 kHz)
	Microphone impedance	600Ω
	Frequency response	400 ~ 2600 Hz (−6 dB) (SSB)
RECEIVER	Circuitry	Triple conversion system
	Intermediate frequency	1st IF—73.05 MHz, 2nd IF—8.83 MHz, 3rd IF—455 kHz
	Image Ratio	780 dB
	IF Rejection	780 dB
	Selectivity	SSB/CW/FSK—2.4 kHz (−6 dB), 3.8 kHz (−60 dB) AM—8 kHz (−6 dB), 15 kHz (−60 dB) FM—12 kHz (− 6 dB), 24 kHz (minus 60 dB)
	RIT/XIT variable range	±1.2 kHz (10 Hz step), ±2.4 kHz (20 Hz step)
	Notch filter attenuation	More than 40 dB, (audio frequency 1.5 kHz)
	Audio output power	1.5W (8Ω at 10% distortion)

DSP-100 Specifications

Mode	J3E (LSB, USB), A1A (CW), A3E (AM), F1A (FSK)
Output frequency	455 kHz
Input frequency	36.891 MHz
Modulation	SSB—Balanced modulation AM—Low level modulation
Dimensions (W x H x D)	270 x 49 x 286mm (10-5/8" x 2-3/16" x 11-1/16")
Weight	3kg (6.6 lbs.)

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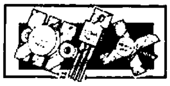

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Half-Wave Gain Antenna

For 450 MHz Handie-Talkies

by Phil Salas AD5X

Over the past decade, the 450 MHz band has become as popular as the 2 meter band. Many 450 MHz repeaters have even more features than 2 meter repeaters, including multiband, cross-band repeater operation. Like 2 meters, handie-talkies are also very popular at 450 MHz. Unfortunately, there's not much to be said for the antennas available on these handie-talkies. This article describes a better antenna solution for your 450 MHz handie-talkie.

450 MHz Antennas

450 MHz antennas are generally a quarter wavelength long (about 6-1/2 inches), but don't perform like quarter-wave antennas. I made some measurements using my handie-talkie antenna mounted on a mag-mount base on my car, and compared them to measurements with the antenna mounted directly on the handie-talkie. My test equipment consisted of an ICOM R-7000 receiver, a Smith Engineering Spectrum Probe, and an oscilloscope to display the spectrum. My measurements were made from a range of 100 feet.

The antenna used on the R-7000 was a half-wave sleeve antenna on the end of a 20-foot piece of RG-8M so that I could move it around and verify that I was not getting signal enhancement or cancellation due to reflections. My tests showed a clear and repeatable 2–3 dB advantage of the handie-talkie antenna when mounted on the car versus mounted on the handie-talkie. I suspected that this was due to the quarter-wave antenna requiring a decent ground plane for proper operation. When mounted on the handie-talkie, the ground plane consists of the handie-talkie electronics and case capacitively coupled to the hand of the user.

If this is the case, then a half-wave antenna might be the solution. A half-wave antenna supplies its own image, and therefore doesn't need a good ground plane. And a half-wavelength at 445 MHz is only 13 inches long—certainly a reasonable handie-talkie antenna length. Unfortunately, an end-fed half-wavelength antenna exhibits a very high feedpoint impedance; fortunately, matching to this impedance is not necessarily difficult.

Half-Wave, End-Fed Antenna

Since the half-wave, end-fed antenna exhibits a high impedance, it can be matched with a parallel tuned circuit, the input to this tuned circuit being tapped at such point to give a 50 ohm impedance. This is shown schematically in Figure 1.

The first part of the job involves preparing

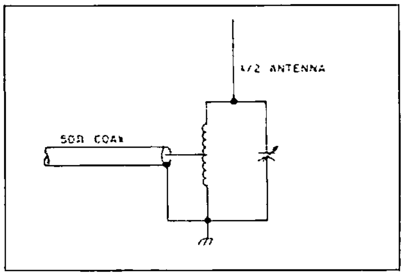

Figure 1. A half-wave gain antenna that takes only an hour to build.

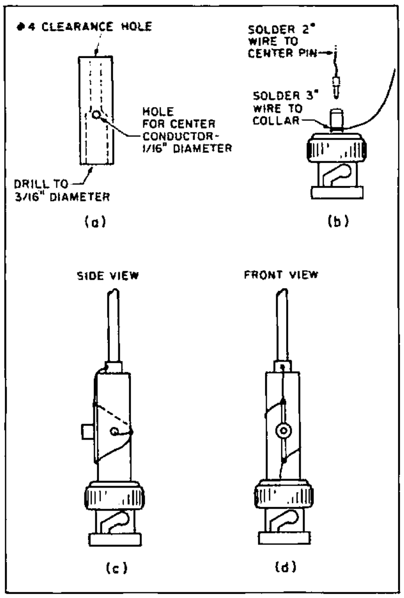

Figure 2. (a) Drilling the holes and (b) soldering the wire. (c) A side and (d) front view of the half-wave gain antenna.

the coil form. The plastic spacer has a small clearance hole drilled through it. Refer to Figure 2. Use a 3/16-inch diameter drill to drill out this clearance hole halfway through the length of the spacer. Now drill a 1/16-inch diameter hole into one side of the spacer as shown in the figure.

Referring to Figure 2(b), solder a three-inch wire to the side of the collar of the BNC plug as shown. Solder a two-inch wire to the center pin. Insert the center pin into the BNC plug. Drop a piece of sleeving over the center pin wire to prevent shorts, and add a drop of quick-setting glue over the end of the insulated wire to keep the center conductor in place.

Add a drop of quick setting glue to the screw threads on the 13-inch telescoping antenna and screw the threads into the spacer. Now feed the free end of the wire soldered to the center pin of the BNC plug into the spacer and out the hole in the side of the spacer. Press the spacer down over the BNC plug's collar such that the side hole is one-forth of the way around the connector from the wire soldered to the connector body. Now we can create the parallel L/C network.

Wrap the wire soldered to the connector body once around the spacer and solder the end to the base of the telescoping whip antenna. Refer to Figures 2(c) and (d), soldering the variable capacitor across the single turn as shown. Finally, bend the center conductor wire extending from the spacer side hole around and solder this wire to the center of the coil exactly opposite the capacitor. You are now ready to adjust the antenna.

Antenna Tune Up

To tune up the antenna, fully extend it, place it directly on the output connector of an SWR meter, and hold it vertically. Since the initial SWR is likely to be quite high, you should operate your transmitter at low power to protect the final output transistor.

Now, key your transmitter and set your forward reference. Switch to reflected power and adjust the capacitor for a minimum reading. It should be easy to see the dip. Reset your forward reference and measure your SWR. It will undoubtedly still be high. Unsolder the center conductor wire from its position on the coil and resolder it repositioned a little closer to the ground

Parts List

crimp-on BNC male plug	50 ohm	Mouser ME174-93701N
spacer	plastic or nylon 5/8"L x 1/4" dia.	Mouser 561-K4.625
capacitor	3.5–20 pf miniature variable	Mouser 24AA072
whip antenna	13" telescoping	Radio Shack 270-1407

I obtained the first three items from Mouser Electronics (800-346-6873). You can get these items from many different suppliers. The variable capacitor needs to cover the 6–10 pF range.

end of the coil. Repeat the capacitor dip adjustment and SWR reading. You may have to move the center conductor wire a few more times, but it will be very easy to achieve an SWR of close to 1:1.

When you have achieved a good SWR, carefully coat the entire coil with hot glue. Do not cover up the variable capacitor yet, though. Also coat the coil/connector and coil/antenna interfaces with hot glue. When the glue cools, re-check the SWR and re-adjust the capacitor if necessary. Now go ahead and cover the variable capacitor with hot glue. Your half-wave antenna is finished!

Antenna Comparisons

I re-ran my antenna tests comparing the half-wave antenna mounted on the handie-talkie with the original quarter-wave rubber duckie also mounted on the handie-talkie. Again, the measurements were made at 100 feet using the ICOM R-7000 receiver, Spectrum Probe, and oscilloscope. I measured a solid 6 db improvement of the half-wave antenna over the standard rubber duckie. This is pretty impressive. It is the equivalent of raising your transmit power by a factor of four!

I have described an inexpensive half-wave gain antenna for your 450 MHz handie-talkie. The total time to build this antenna after you have all the parts is only about an hour. Not bad for a 6 dB gain advantage! 73

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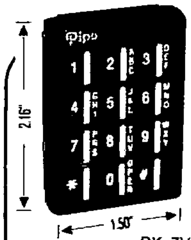

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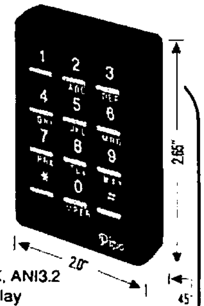

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73 Review *by Larry R. Antonuk WB9RRT*

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Model 3500 Frequency Counter

Speed, accuracy, and ease in a shirt-pocket unit.

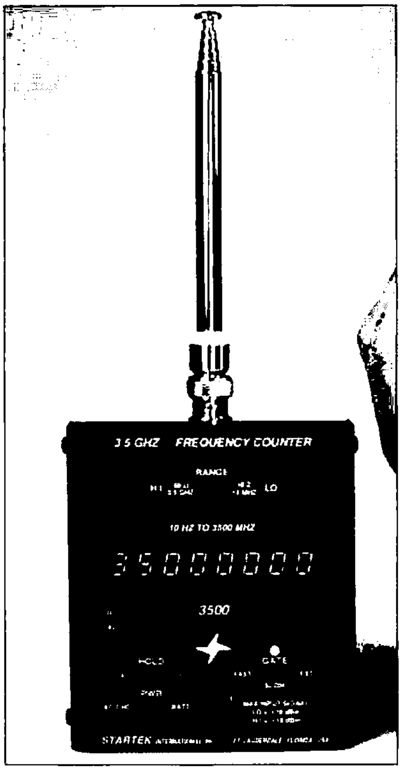
In the old days, you could tell a lot about a ham radio operator just by looking at his workbench. A fast glance over a ham's tools and test equipment can quickly determine his level of expertise and commitment. What do you see? A cereal box DC voltmeter and a CB SWR bridge? (Hmmm. Not too serious.) A decent meter, an audio signal generator, and a few home-brew gadgets? (Getting closer.) Eight or 10 big mysterious boxes, an oscilloscope or two on a cart, and a big RF frequency counter? (Aha! A real hard-core.) A digital voltmeter and a shirt-pocket frequency counter . . .

A shirt-pocket *what*? A shirt-pocket frequency counter. Those of us who grew up with 80-pound boat anchors sporting dancing Nixie tubes and prescalers may find it hard to believe, but the Startek International Model 3500 does indeed fit in a standard shirt pocket (as does the whole Startek line). Not only does the 3500 take up less space than your old buddy, but it's faster, easier to use, and more accurate. How do they do it?

Micro Package—Big Features

The answer, of course, is modern technology. The Model 3500 uses a combination of LSI and MMIC chip technology to produce a device that is extremely sensitive over a wide frequency range. Like most counters, the unit has selectable ranges, in this case 10 Hz to 12 MHz and 10 MHz to 3.5 GHz. Unlike older models, the 3500 selects a high impedance mode for the low range, and a 50 ohm impedance for the high range. This eliminates the problem that often occurs when trying to measure the frequency of a low-level oscillator in a radio. A standard counter will load down the circuit, killing the oscillations. Even worse, in some situations the counter will load down the circuit just enough to vary the actual frequency of the oscillator. This produces a respectable-looking but entirely incorrect reading. The high impedance mode fixes both of these problems.

The 3500 and the entire Startek line all use eight-digit LED displays. The debate over LEDs versus LCDs will probably go on forever, but I prefer LEDs. The majority of radio service work is done in dimly lit areas—basements, attics, hilltop radio shacks—where the LED outperforms the LCD hands down. In addition, in the few instances where the unit needs to be used outdoors, the display is easily shielded.



The Startek Model 3500 frequency counter.

The display resolution changes along with the GATE switch. Using the EXT gate position, you can resolve frequencies down to 0.1 Hz on the low range and 10 Hz on the high range. One nice feature of the 3500 is the ability to select three different gate times (see the table for gate times versus resolution). A DISPLAY HOLD feature locks the active readout for later reference or recording. Maximum input levels are stated to be +10 dBw and +15 dBm for the low and high ranges, respectively. These values figure out to 10 watts and 30 mW, respectively. This means that the 3500 has a high degree of overload protection, but it doesn't mean it's bulletproof. It will still die if you key your mobile rig directly into it. However, it's less likely to become "deaf" from people waving handhelds next to its antenna.

Sensitivity

Sensitivity figures for the 3500 are shown in the table. The review unit exceeded these values across the entire range of frequencies. This is impressive enough from a technical standpoint, but what it means in terms of actual use is even more exciting.

The days of counter preamps are long gone. Not only are the Startek counters sensitive enough for any general troubleshooting, they also work well for remotely monitoring transmissions. The 3500 was able to reliably count the frequency of a 2 meter, 5 watt handheld, using a rubber ducky antenna, at 150 feet. A 50 mW signal operating into a one-foot whip could be read at 20 feet. This characteristic makes the counter a very versatile tool. Public service monitoring, surveillance work, intermod and interference problems, transmitter hunting—several applications immediately become apparent. (If you've always wondered what the frequency was at the drive-in window of Bob's Taco Stand, this is the instrument for you.)

Unlike most RF counters, this unit works well down to 10 Hz. This makes it useful for a variety of audio functions as well—counting CTCSS (PL) tones, checking DTMF microphone frequencies, and verifying two-tone encoder tones.

Features

The Model 3500 comes with the basic supplies needed for day-to-day use: a built-in NiCd supply and a plug-in wall charger. (A telescoping antenna to fit the BNC input jack is available as an option.) Optional accessories include a carrying case, different probes for "in circuit" testing, and a rubber duck style antenna. The NiCd pack will power the unit for four hours before recharging.

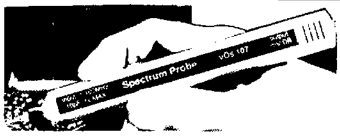
The idea of servicing a service instrument is never foremost on one's mind when buying one, but the Startek counter carries a one-year parts and labor warranty. Due to its size, the unit will spend most of its time in a relatively safe corner of a toolbox or coat pocket, but

Model 3500 Specifications

Range	Overall	10 Hz–3.5 GHz			
	Lo Range	10 Hz–12 MHz			
	Hi Range	10 MHz–3.5 GHz			
Display	8 red LED digits, 0.28″ (height)				
	Auto decimal point placement				
Resolution & Gate Times	Lo Range	Gate	Fast	10 Hz	0.1 sec.
			Slow	1.0 Hz	1.0 sec.
			Ext	0.1 Hz	10.0 sec.
	Hi Range	Gate	Fast	1.0 kHz	0.25 sec.
			Slow	100 Hz	2.5 sec.
			Ext	10 Hz	25.0 sec.
Time Base Clock Frequency	Lo Range	10.000000 MHz, TCXO			
	Hi Range	3.906250 MHz, TCXO			
Accuracy to Calibration	±0.0001% +1 count LSD, 25–35 DEG/C typ. (± 1 ppm overall)				
	Xtal aging	1 PPM/year typ.			
Signal Input	Lo Range	1 megohm impedance	22.0V max.		
	Hi Range	50 ohm impedance	1.2V max.		
Sensitivity (Typical)	Lo Range	1–10 mV RMS			
	Hi Range	10 MHz–2 GHz	1–10 mV RMS		
		2–2.4 GHz	10–20 mV RMS		
		2.4–3 GHz	15–50 mV RMS		
Power Required	9–12 VDC (9 VDC @ 300–500 mA adaptor), auto polarity				
Battery Operation	3–5 hrs. usage, 16 hrs. full charge				
	600 mA/hr. Panasonic NiCd batteries				

it's rugged enough to take a fair amount of dropping. (The author's Model 1500 spent most of the summer up towers and on rooftops aligning the 230 MHz IF of 23 GHz microwave lines, and took quite a few tumbles in the process—a real testimony to the physical quality of these counters.)

The Startek 3500 is inexpensive enough and portable enough to be used for a variety of purposes. Frequency netting and calibration, general audio and RF troubleshooting, providing accurate readouts for older RF signal generators—whatever the use, the 3500 will give a vast amount of performance at a very modest price. The next time you're at a hamfest and someone wonders what frequency that old commercial rig is on, just reach into your shirt pocket. 73



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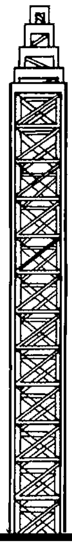

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The Heli-Hat Antenna

An 18-inch wonder for 10–17 meters.

by J. Frank Brumbaugh KB4ZGC

What is compact, portable, and efficient? Covers 17 through 10 meters? Is omnidirectional, with low angle radiation? Reduces QRM, QRN, and harmonics? Has one-knob tuning for low SWR?

More and more hams find themselves living in subdivisions, apartments, and condominiums where deed and building restrictions make normal antenna installations impossible. Hams in mobile home parks, and those ranging the country in motor homes, have few options for useful antennas other than loaded vertical whips—mobile antennas. These are useful for the higher HF bands, but commercial versions are very expensive. What they need is an antenna with the above features.

Although I now have a 40 meter dipole for HF use, there have been many times during my 40-plus years as a rag-chewer when I lived in locations where even a whip antenna on a balcony was frowned upon. I experimented with many different antenna configurations. Some worked quite well. Others were duds. The more-or-less standard dipoles and quarter-wave wires, even bent to fit the available indoor space, generally gave satisfactory results when properly tuned. However, even small gauge wires strung around a small apartment were sometimes noticed and questioned by landlords, requiring elaborate explanations—lies—which seldom were believed. What was needed was a compact, effective HF antenna that could be easily hidden in a closet or attic when "official" visitors were expected.

Such an antenna should be of a size that could easily be transported in an automobile and rapidly set up in a motel room, or even put on top of the car for fixed mobile operation on Field Day. The Heli-Hat Antenna was my solution to this problem. It has all the features I opened this article with!

Originally designed before WARC to operate on 10 and 15 meters, it has been used since then on 17 and 12 meters, and results have been most satisfactory. This antenna may well be of interest to other hams with similar antenna problems, or as a "quick and dirty" Field Day antenna.

Table. Taps vs. Frequency

Band, Meters	Tap	SWR
17	7	1.1:1
15	7	1.2:1
12	6	1.2:1
10	6	1.1:1

Note: Tap points measured from bottom of helix. The 10-meter tap is for 28.4 MHz and may vary at higher frequencies. Taps for other bands are for centers of bands.

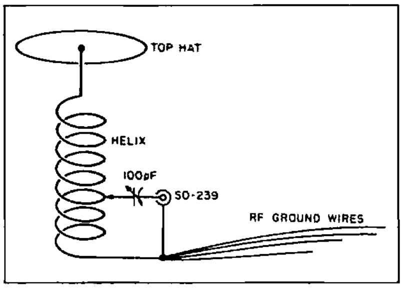

Figure 1. Heli-Hat antenna schematic diagram.

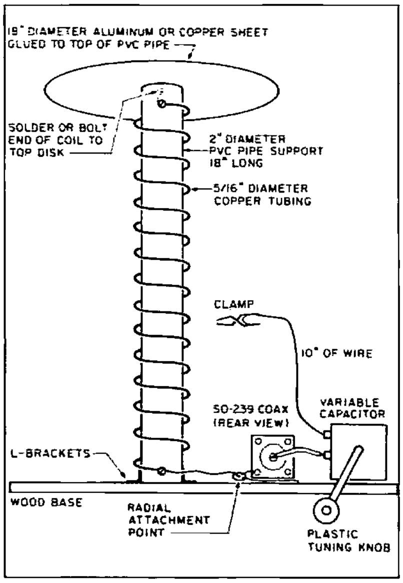

Figure 2. Construction details of the Heli-Hat.

Heli-Hat Antenna

The antenna, illustrated schematically in Figure 1, covers the 17, 15, 12 and 10 meter bands. It includes one-knob tuning so SWR can be reduced well below 1.5:1—usually 1.1:1 or 1.2:1, making it compatible with modern solid-state transceivers. It is compact, fitting into a space approximately 18 inches high and 18 inches in diameter. With the top hat removed it takes up about as much space as two loaves of bread staked end-to-end.

Basically, the antenna is a tuned, top-loaded helix. A portion of the base of the helix, tuned by a 100 pF variable capacitor, resonates at the operating frequency and simultaneously presents a nonreactive 50 ohm load to the transmitter or transceiver. The upper portion of the helix is tuned by the effective capacitance of the top hat at the operating frequency. The entire antenna structure radiates.

This is a high-Q antenna, so it exhibits a relatively narrow bandwidth. This requires slight adjustment of the tuning if a large frequency excursion is made, especially on the 15 and 10 meter bands. A major advantage of such a high-Q antenna is that it rejects any harmonic energy which may be present on transmit, and on receive it reduces the level of signals near the operating frequency in a manner similar to the way a peaked filter functions. Not only will this antenna reduce QRM, it also reduces QRN to a great extent because of its narrow bandwidth.

The base of the helix must be grounded for RF. In most indoor installations this can be best accomplished by attaching open-ended quarter-wavelength wires to the ground connection, a solder lug on one of the screws holding the RF connector to the antenna base. Ground wires can be stretched out while operating, and rolled up and stowed with the antenna when not in use.

For operation on all four HF bands, the four wires should be cut to 13 feet 7 inches; 11 feet 7 inches; 9 feet 10 inches; and 8 feet 6 inches, respectively, for the 17, 15, 12 and 10 meter bands. Four separate insulated wires can be used; or two pairs of 2-conductor speaker wire, or even a length of 4-wire telephone cable such as that used indoors. Each wire should be cut to the length specified, and one end of all wires connected to the ground lug on the SO-239 RF connector on the antenna.

Continued on page 35

Continued from page 32

WARNING: *When transmitting, the entire antenna structure as well as the open ends of the ground wires will exhibit high RF voltages which can produce burns if touched. Be certain your installation is protected from being touched by children or pets.*

Finding The Parts

New copper tubing is rather expensive, but the length required should not break any ham's budget. Scrap tubing, copper or aluminum, is often available for little or nothing at businesses involved in manufacturing and installation of refrigeration and heating/air-conditioning systems. The tubing I used was obtained from an air-conditioning installer for $2.00. It is also often possible to locate a sufficient length of cable TV hard-line—spool ends containing as much as 80 or 90 feet are usually discarded—and if you explain your intended use to one of the technicians, you probably can get as much as you need free of charge. Although copper tubing is best, aluminum can be used in constructing the Heli-Hat antenna.

The 100 pF variable capacitor I used has 0.03-inch plate spacing, which is OK for up to 100 watts. For 500 watts a plate spacing of 0.05 inches is recommended, and up to 0.1-inch spacing for maximum legal power. My capacitor came from the lowest depths of my junk box. It is odd, with trapezoidal-shaped stator plates, removed long ago from some esoteric military "boat anchor."

Fair Radio Sales, P.O. Box 1105, Lima OH 45802, has a broad selection of surplus variable capacitors at prices ranging from $1.25 to several dollars. (New variable capacitors bear prices that equal a day's wages or more! Surplus is better.) However, before spending scarce dollars, check with local hams and the flea markets at hamfests for a suitable capacitor. Also, Radiokit at P.O. Box 973, Pelham NH 03076, tel: (603) 635-2235, carries a number of suitable capacitors. Two good candidates are their model number 284130 for higher power, and number 23100MK for under 100 watts.

Aluminum sheets two feet square are often available in hardware stores as "Reynolds® Do-it Yourself" supplies. Hardware and building supply stores also usually have two-foot-wide aluminum flashing for sale. Either will be suitable for the top hat, which is 18 inches in diameter.

Scrap PVC pipe and wood for the antenna base may often be found in scrap piles behind hardware and building supply stores, although the short length of pipe needed should cost less than a dollar purchased new. It can be either larger or smaller in diameter than that specified herein. Its only function is to provide stability to the tubing helix.

Construction

The helix consists of 15 turns of 5/16-inch copper tubing about 4-3/4 inches in diameter, with the turns evenly spaced over a length of 14 inches. The total length of tubing is about 19 feet. The helix was formed by winding around a cardboard tube about 3-1/2 inches in diameter, springing to its final diameter when removed from the cardboard. Ends of the tubing are flattened and drilled to accept long machine screws, then slipped over the PVC pipe and bolted through it. The pipe is about 18 inches long and about 2 inches in diameter.

NOTE: The dimensions given are those of my antenna. You may make any changes *within reason* in any of these dimensions. Tubing of larger or smaller diameter can be used; overall tubing length can be greater or a bit less. Helix diameter can be reduced and length extended. The result of such minor changes may change the position of the tap point for one or more bands but otherwise should make no important difference.

The top hat is an 18-inch diameter disc of aluminum sheet with an area of over 254 square inches. It need not be round as long as the area is close to 254 square inches. The effective capacitance of the top hat is important to both the frequency range covered and to the Q of the antenna.

The top hat can be attached to the top of the PVC pipe with epoxy or hot glue. A ground lug attached to the underside of the tip hat near the PVC pipe is used to connect a short wire jumper between it and the top of the helix.

The lower end of the PVC pipe can be mounted on a short piece of wood, plywood or plastic, using brackets and machine screws. It may also be attached with epoxy or hot glue, although this will not produce a very strong joint.

The tuning capacitor must have both rotor and stator plates insulated from ground because it is in series with the RF from the transmitter or transceiver and the tap on the helix. Either a length of insulating shaft or a large plastic knob must be used on the tuning capacitor shaft, which will be "hot" with RF. Mount the capacitor on the base near the PVC pipe.

An SO-239 RF connector can be connected to a bracket attached to the antenna base near the tuning capacitor. Mount a ground lug under two of the screws holding the connector on the bracket. Connect a wire jumper from one ground lug to the base of the helix. The other ground lug is the connection for the four RF ground wires mentioned earlier.

Connect a wire jumper between the center terminal of the SO-239 to either the rotor or stator of the tuning capacitor. Solder both connections.

Strip some insulation from both ends of a flexible stranded wire of AWG #16 or larger and about 10 or 12 inches long. Connect one end to the unused terminal on the tuning capacitor, and solder.

Connect a spring clip to the other end of this wire. An alligator or crocodile clip may be used, but a small spring clip of the type used on automobile jumper cables and battery chargers works best. This clip is used to establish the tap point of the helix for each band, and must make a solid, low resistance connection.

Operation

Attach the ground wires to the unused solder lug on the SO-239 connector and stretch them out more-or-less in a straight line. Using a coaxial jumper, connect the RF output of your transceiver or transmitter to the SO-239 on the antenna, providing your rig includes a means for monitoring SWR. If it does not, an SWR meter must be connected between the transmitter or transceiver and the antenna.

If you've followed the measurements given in this article closely, position the tap on the helix as indicated in the table. If your antenna differs in dimensions, the proper tap point must be determined experimentally.

Apply 10 to 25 watts to the antenna and adjust the tuning capacitor for the lowest SWR. In some installations it may be necessary to move the tap point on the helix one-half to one turn higher or lower to achieve an SWR of 1.1 or 1.2, although if the SWR is at least below 1.5:1, modern solid-state rigs will operate satisfactorily.

Monitor the SWR when you change frequencies or bands, and change the tap position and adjust the tuning capacitor as necessary to maintain low SWR.

Conclusion

The Heli-Hat antenna is omnidirectional and radiates much of the RF at the low vertical angles best for DX. It is a high-Q antenna with a narrow bandwidth around the operating frequency, resulting in the reduction of QRM and QRN on receive, and greatly reducing the level of any harmonic energy that might be present in the output of the transmitter or transceiver. It covers all four ham bands from 17 through 10 meters and is easily tuned for a very low SWR. The antenna is easily set up indoors or out, and is easy to conceal when not in use. It can, in many cases, be constructed wholly from scrap.

Although the Heli-Hat antenna was designed to cover only the four highest HF bands, theory suggests it also could be tuned on 6 meters, and possibly 2 meters as well, by tapping the helix closer to ground. Not having equipment for these bands, I was unable to check for operation on these frequencies.

Too, if the helix is made from a longer length of tubing, and perhaps has a larger top hat, it should be possible to extend the lower frequency limit to include the 20 meter band without making the antenna much larger.

Although the Heli-Hat antenna is not intended to compete with a 6-element monoband beam on a 100-foot tower, it will give a good account of itself on the four ham bands for which it was designed, especially on crowded bands where its high Q is a distinct advantage.

This antenna also can be a starting point for experimentally minded hams who may be interested in modifying it to cover other frequency ranges.

You may write J. Frank Brumbaugh KB4ZGC at 1812 Marilyn Ave., Bradenton FL 34207-4743. Please enclose an SASE if you request information.

Solarcon
7134 Railroad Street, P.O. Box 176
Holland OH 43528
Telephone: (800) 445-3991
Price Class: $75

73 Review

by Bill Clarke WA4BLC

The Solarcon A-99 Antenna

A very economical vertical for 10–17 meters!

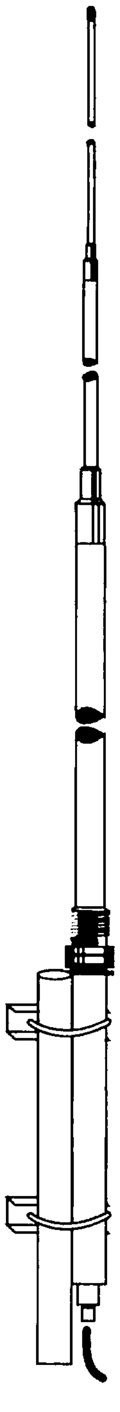

Figure. Diagram of the Solarcon A-99 antenna.

A while back I was reading one of the ham magazines and saw an advertisement that really piqued my interest. It said, "World's top performing fiberglass omnidirectional base station antenna," then went on to say that it operates 12–10 meters. This was too much to let pass by, so I sent for one.

The box arrived via UPS and inside were three pieces of fiberglass-covered tubular antenna. I also found an instruction sheet and a few other papers. I quickly went about getting the antenna into the air for testing.

Assembly

This antenna is easy to assemble. The three pieces screw into each other and the bottom of the antenna has a metal sleeve which is then attached to a tower, post, or mast with U-bolts. Coax is attached to a weather-protected connector in the center of the antenna's base.

For the first few days of evaluation, I bolted the antenna to an eight-foot-long, two-inch-diameter wood rod and tied it to the side of my tractor, which was then parked about 75 feet from the house.

I ran a piece of RG-8X from the antenna into the shack and tuned up on 10 meters. The band was semi-open so I called a CQ and was immediately answered. From there on I played DX the rest of the day. By the time the bands went out I had worked about 40 countries, all with nice QSOs. Most impressive for an 18-foot piece of white fiberglass.

On-the-Air

It worked fine on 10 meters. After all, that's right next to 11 meters (the A-99 was originally designed for the Citizens Band). It should work there. The SWR was below 1.2:1 below 29 MHz. The next day I operated on 12 meters (SWR 1.8:1) and was pleased to find that the antenna performed as well on 12 as it did on 10.

Towards the end of the day I became bored with 12 and decided to see what other surprises the A-99 held. I put the rig on 17 meters and heard all kinds of activity—the band was in very good shape.

The antenna loaded with a 2.5:1 SWR. My rig can handle this, but I smoothed it out with a tuner and went to calling CQ. Just like on 10 and 12 meters, I got responses from all over.

To make a long story short, I have now played with this antenna for about four weeks and have found that it works very well on 17 through 10 meters. It won't make it down to 20 meters or below, however.

My testing was done with and without the optional radial kit. I could find no particular difference in performance either way, although there were some very minor changes in the SWR curves.

A Best Kept Secret

In talking with European hams, I discovered that many of them were using CB antennas of one type or another, and that this practice was not only economical but easy as well, and prevented visual intrusion complaints from the neighbors. One chap claimed to have worked 214 countries during the past year with an antenna similar to the A-99.

Could it really be that bigger isn't always better? Could it be that in our search for simple and effective antennas, hams have overlooked the obvious? I doubt if I am crushing any rocks out there in the pile-ups, but I get my share of contacts with this antenna.

Alternatives to Spending $300+

Although most of the competing antennas do offer 20 meter coverage, they also cost two to three hundred dollars more than the A-99. I'm not sure if using 14.313 MHz is worth the extra cost!

High Points

- The recommended retail price for the A-99 antenna is a very modest $74.50 (cheap).
- There are no moving parts on the antenna to wear out.
- It comes in only three pieces which can be assembled in about that number of minutes (simple).
- It can be mounted on the ground, on a mast, or on a roof. I suppose it could even be hidden in a tree. In fact, you can paint it to match the tree if you wish!
- No radials! The entire structure is a little less than 18 feet tall and about an inch in diameter.
- A nice info sheet about installing antennas is included, bringing out some areas of safety that should be revisited from time to time.
- The manufacturer's warranty policy is excellent. If the A-99 fails, it will be repaired or replaced, except in cases of damage or misuse, with no specified time limit.

Recommendations

The A-99 is a very economical and easy means for gaining access to 10–17 meters and getting a good signal out. Feed it with RG-8X for power levels under 200 watts, and RG-8 for higher power levels.

Although I experienced no stray RF problems, I placed an RF choke of six or seven turns of coax about six inches in diameter immediately at the base of the antenna.

You may want to use an antenna tuner to keep the SWR under control for solid-state rigs. If you place the antenna out in the open away from obstructions, you will probably only need a tuner when operating on the 17 meter band. I tried a rig with an internal automatic antenna tuner and found it loaded up easily into the A-99 on any band between 10 and 17 meters. In fact, the automatic tuner made a wonderful companion for the A-99. For a manual tuner, any of the inexpensive tuners should do quite nicely.

By the way, my A-99 is mounted on a 1-1/2 inch diameter galvanized pipe about four feet above ground level, and about 50 feet from the house.

Availability of the A-99

Solarcon has been manufacturing antennas for CB, cellular, and business users since 1975 and distributes worldwide. For the name of a dealer near you, contact Solarcon.

A-99 Specifications

The following is a modified list of specifications which reflect my test results:

Description	Fiberglass-covered vertical antenna
Height	17'8" (separates into 3 sections)
Bands	17–10 meters
Power limits	2 kW
Mounting	1-1/2" mast max.
Grounding	DC grounded
Useful radiation angle	< 20 degrees 10–17 (as plotted with ELNEC)
Radials	Optional, but not needed
Safety	CPSC shock hazard standards to 14,500 volts

Gain: About 0 dBd (unity gain, compared with a dipole)

SWR: < 1.2:1—10m (under 29 MHz) • < 1.8:1—12m • < 2.5:1—17m •

NOTE: The SWR may vary depending on your antenna location.

Showdown in Portland

Discover the thrill of radiosporting.

by Joe Moell KØOV

In an ordinary DX competition, the contestants stay in their shacks in their own countries. They link with each other via the ether for only a few seconds, two at a time. Months later, they read the results in a magazine.

That's fun. But now, imagine an international amateur radio competition where the entrants spend a week together. They stay in one another's homes. They dine in large groups. Their families become good friends.

They challenge each other in the usual time-honored hamshack events, plus Morse contests and radio direction finding "foxhunts." The results are known immediately. There are opening ceremonies and a closing banquet, followed by misty-eyed good-byes.

More fun? You bet. At least 20 dB more, I'd say. Continent-wide radiosporting contests like this have been regular events in Europe and Asia for many years, but they are new to the USA. That's changing, thanks to the Friendship Amateur Radio Society (FARS).

FARS is a not-for-profit organization based in Portland, Oregon. It has a counterpart organization in Khabarovsk, a city of similar size in eastern USSR. Two years ago, hams from Portland went to Khabarovsk for a week of radiosporting activities.

This year it was Portland's turn to host. During the week after Memorial Day, FARS-USA welcomed hams to the second Friendship Radiosport Games (FRG-91). There were all the events usually found at a European/Asian radiosport festival, including DX contests, a CW competition, and the first internationally sanctioned foxhunt in the USA. On hand to compete were 10 Soviet, three Japanese, and 20 US hams.

First, the Foxhunt

In the USA, radio direction finding (RDF) contests are called hidden transmitter hunts, or T-hunts. They involve cars, trucks, and vans outfitted with strange antennas and blinking consoles. It's more like a road rally than a race.

International radiosport RDF, usually called foxhunting, allows no such luxury. It's all done on foot. Speed determines the winner. So, there's no place for the unfit (Photo A).

The site was Portland's Forest Park, a giant wooded labyrinth of trails, trees, and hills. The weather alternated between rain and sun. Somewhere in those 200 rugged acres were five yellow metal boxes, transmitting a few milliwatts on 146.565 MHz. Fox number one came on for one minute, then number two, and so on. To win the event, all you had to do was be the first to find all five, in numerical order, and get back to the start/finish line.

Sound easy? You try it! Even the winners, seasoned Northwest ELT team members and intrepid Southern California T-hunters, got a real workout (Photo B). Since each transmitter is on the air only 20 percent of the time, it's important to plot the bearings to each one often, and carefully triangulate on the maps provided.

Photo B. Kevin Kelly N6QAB won the foxhunt by finding all five transmitters on the two-mile course in less than one and a quarter hours.

It was a dual challenge: Both physical stamina and technical expertise were needed to win. Almost all contestants were headed for the liniment and foot baths after the rigors of this event.

Photo A. Yoshiko Yamagami JQ1LCW is a champion at "fox-teering," as it's called in Japan, but she had never used an American switched-antenna RDF set. Still, she finished fourth out of 15 entrants in the FRG-91 foxhunt.

Round-Robin DX

There was little time for recuperation after the foxhunt: the DX competition was the next day. Five of Portland's best-equipped hamshacks (W7NI, K2RAG, W7EJ, WR7D, and K7RO) rolled out the red carpet to the five international teams.

To insure that no team had an advantage or disadvantage because of the features of a particular station, the teams rotated. Each team spent one hour at each station, with an hour off for travel between operating periods. Thus, the contest period was nine hours, with only five hours actual on-air time.

By now, the competitors sensed that Murphy had connections with Old Sol as well as with the weatherman. Band conditions were anything but hot. Hopes by the Soviets and Japanese of racking up scads of contacts with their homelands were not to be realized (Photo C).

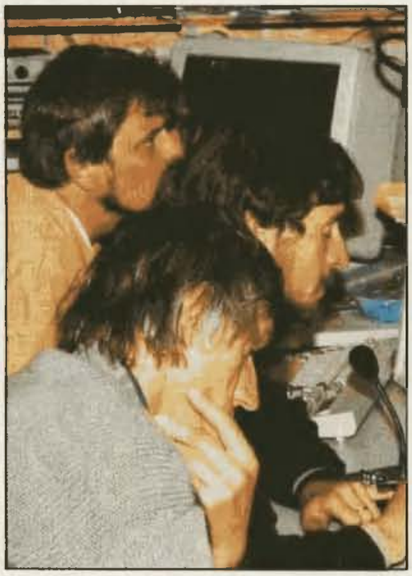

Photo C. These Morse experts on the USSR-Red team made the most CW contacts in FRG-91. They are (front to back) Slava Alexandrov UW0CD, Mikhail Zavarukhin UW0CN, and Igor Krivosheev UA0CZ, in the computer-filled shack of WR7D.

The three-page set of rules for the HF test included "counters" for countries and US/VE/JA prefixes. To insure accuracy, there was a three-QSO penalty for "busted calls," plus additional penalties for incomplete exchanges and invalid QSOs.

All logging was done on computers provided by FARS. The sponsors also provided assistants to enter calls into the computers in real time.

Pressing their home court advantage, US teams took the gold and silver (Photo D). A USSR team was in third place, despite having fewer total QSOs than the Japanese team. The JAs made no CW contacts, which put them at a major disadvantage in the convoluted scoring system.

Speedy Telegraphy

Friday night, it was time to take off to Seaside, Oregon, a coastal vacation spot 80 miles northwest of Portland, for the remainder of the events. The Sea-Pac convention that weekend gave the foreign entrants a chance to meet hundreds of US hams. It also attracted the Northwest's top CW operators to take them on.

After a leisurely practice session at 20 wpm, Mark Sinnard N6OPN cranked up the computer and let the dits and dahs fly for the high-speed receiving test (Photo E). By the end of the 35 wpm round, only three entrants were able to copy for a solid minute. Based on their accuracy in that round, the individual medal winners were selected.

But Mark wasn't through with his torture—it was time for the pile-up contest (Photo F). By this time, hunger and other activities had lured some of the worldclass CW experts out of the FARS room and onto the convention floor. There was a shortage of contestants, so I grabbed a pencil and a set of earphones, and sat down in one of the empty seats.

The pile-up tape began with a plaintive "QRZ DX" by W2NSD/1. (Now where have I heard that call before?) For the next six minutes, it was non-stop CW bedlam ringing in my head, as no less that 101 rare stations called poor Wayne. They were all on top of one another, at varying levels, with lots of noise and QRN mixed in.

What a mess! Somehow I managed to scribble down enough callsigns to stay out of last place. But my list had nowhere near the 34 calls that winner Jim Fenstermaker K9JF got. How does he do it?

There was no lack of entrants for the next event: CW sending. Even Dima Ornatsky, the 12-year-old SWL grandson of RW0CA, gave it a try. The Soviet sending style is much different from the traditional J-38 grasp of American hams.

Russian straight keys have a big knob on them and are placed at the very edge of the table. These fellows used their arms as much as their wrists. They did well, but couldn't top "Faster than Baudot" Dale Jones K5MM.

Photo D. At W7NI's super-station: A good balance of SSB QSOs, CW QSOs, and "counters" captured the gold for the US-Blue team, including Jim Fenstermaker K9JF (left) and Paul Kiesel K7CW (right).

Photo E. Bob Bergert K0PB (left), Dale Jones K5MM (right), and J. Scott Bovitz N6MI (rear table) make fast CW receiving seem easy. Dale took first place and Scott took third.

When the final scores for all events were tallied, there was a tie for the gold between the Red and Blue teams from the USA. The USSR-Blue team took the bronze. But there was no talk of victory or defeat at the awards ceremony, just a celebration of the international camaraderie that amateur radio can provide.

East Meets West

To the Soviets, a trip to a US ham convention must seem like visiting another planet. They come from a country which does no manufacturing of ham gear. Soviet amateurs must build their own sets from whatever parts they can scrounge.

There was little scrounging to be done at the convention, because the Russian ruble is not an international currency. Fortunately, they had brought a few items for sale and barter, which were eagerly snapped up by the convention-goers.

Since the Chernobyl accident and the earth-

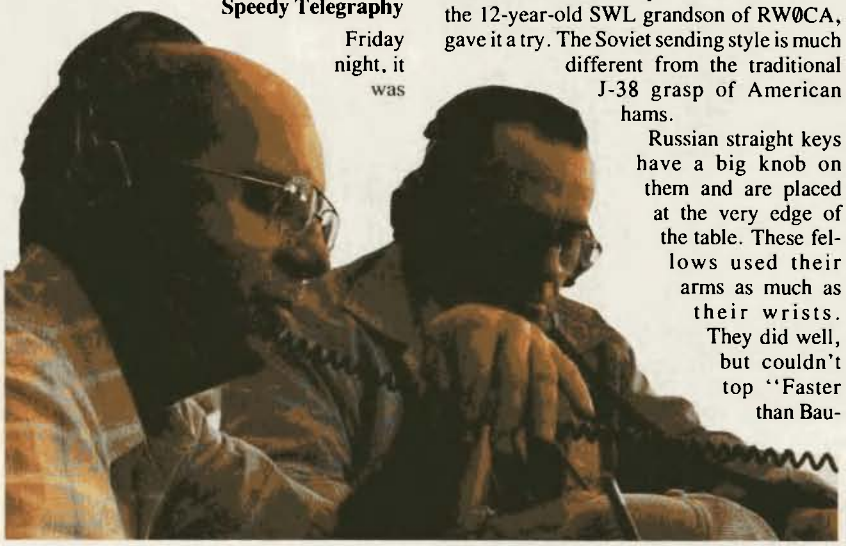

Photo F. Don Calbick W7GB (left) took second place in the brutal CW pile-up test. Harry Lewis W7JWJ (right) won the gold for high speed CW receiving.

FRG-91 Individual Medalists
(Calls indicate nationality)

Event	First	Second	Third
Foxhunt	Kevin Kelly N6QAB	Mike McCarter KA7NOO	Lewis Osborn KC7MZ
CW Receiving	Harry Lewis W7JWJ	Dale Jones K5MM	J. Scott Bovitz N6MI
CW Pile-Up	Jim Fenstermaker K9JF	Don Calbick W7GB	Al Rovner WA2TMP
CW Sending	Dale Jones K5MM	Mikhail Zavarukhin UW0CN	Vlad Gorelik RW0CA

FRG-91 Sponsors and Donors
(in alphabetical order)

AEA	CW Sending Equipment
BMG Engineering	RDF Sets
Delta Airlines	Transportation
Gates Energy Products	Batteries
Kenwood USA	Handhelds
Ron Seese N6NBR	Fox Controllers

FRG-91 Team Medals

Event	First	Second	Third
Foxhunt	USA-Red (KA7NOO, KC7MZ, WB6JGV)	USA-Blue (N6QAB, N6MI)	Japan (JQ1LCW, JN1JPX, JR1WYB)
Operating	USA-Blue (W7RM, K9JF, W7WA, K7CW)	USA-Red (W3XY, WA7VTD, AI7B, WB7RFA)	USSR-Blue (UW0CA, captain)
CW Pile-Up	USA-Red (W7GB, WA2TMP)	USSR-Blue (UA0CZ, UW0CD)	USA-Blue (K9JF, N6MI, K0OV)
CW Sending	USA-Blue (K5MM, W7GB, W7VSE)	USSR-Red (RW0CA, UA0CDX, UW0CA)	USA-Red (WA7VTD, WA0DIM, W7JWJ)

quakes in Armenia, Soviet leaders are paying more attention to amateur radio as an emergency communications resource. At a special Sea-Pac convention forum, Mikhail Zavarukhin UW0CN and Gene Shulgin UZ3AU heard how hams in the USA are organized to assist these calamities. Gene is Technical Editor of *Radio*, a Soviet magazine for amateur radio experimenters. He is also Technical Advisor to the Soviet Amateur Radio Emergency Service (SARES). UZ3AU explained that Russian hams would like to emulate our ARES and RACES, but it would be very difficult. Equipment for HF bands is in very short supply. Mobile gear is almost non-existent. He is presently home-brewing some portable sets especially for future disaster use.

On VHF, it's even worse. Two meters is a seldom-used band. Mike and Gene said they knew of only one repeater. It's in Moscow, many miles from recent disaster sites. Shirt-pocket handhelds, an everyday item in the USA, are never seen there.

Oregon/Washington area hams want to help, and are collecting equipment and dollars to provide more repeaters for emergency use in the USSR. But Gene cautioned that radio equipment and money should always be sent to SARES by courier. If anything of value is mailed, they warned, it will never arrive at its intended destination.

The future is bright for international radiosporting events. FARS is already planning for the next Friendship Radio Games in Japan in 1993. If you start training now, you could become an internationally famous ham radio athlete! 73

Joe Moell K0OV is the "Homing In" columnist for 73 Amateur Radio Today. He won't walk a mile for a Camel, but he'll drive a thousand miles for a foxhunt. For more information about FARS and radiosporting, send an SASE to Friendship Amateur Radio Society, P.O. Box 13344, Portland, Oregon 97213.

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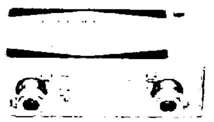

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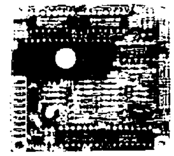

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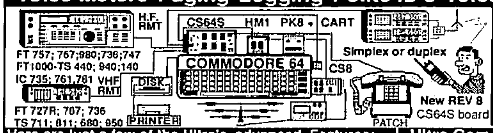

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Microprocessor Repeater Controller, Part II

This month . . . the audio board.

by John Bednar WB3ESS

Last month we looked at the microprocessor repeater controller board. This month, we will discuss the companion audio board which will complete the repeater controller. The audio board, when controlled by the microprocessor board, allows you to select between a variety of different audio sources in a very versatile configuration.

The Audio Board

During the layout of this board it quickly became apparent that there would be too many jumpers on a single-sided board. Therefore, the board was fabricated double-sided without plated through-holes. The latter reduces cost, but makes soldering necessary where traces meet on both board surfaces. Figure 1 is a simple block diagram of the audio board. Though it has many audio inputs and outputs, only a few are used in a basic repeater installation. These extra audio ports allow for future expansion.

The audio board was designed to have a flat frequency response down to about 100 Hz. This should be ideal for those who use discriminator audio from the receivers, and bypass the mike inputs on the transmitters. Depending on the hardware you use, some external frequency tailoring circuits may be necessary. For added convenience, the board was laid out to accept multi-turn pots which can be purchased with top or side adjustments. These pots are placed along the edge of the board so that either pot may be used.

Figure 2 is the schematic for the audio board. Single supply op amps, 4066 audio gates, and CMOS ICs are used throughout. Audio gating is provided so that unsquelched discriminator audio can be used from all receivers. Also provided on this board is a telephone interface, local speaker driver, and PL (private line) gating logic. The PL logic allows simple installation of PL to the repeater. The circuits on the board allow the repeater receiver audio to be gated to the phone, repeater transmitter, or link transmitter. Similarly, the link and auxiliary audio inputs are gated and connected to the three audio outputs. For added flexibility, a simple summing input was added at each output op amp for summing ID tone generators or any other capacitively coupled source. With all these input and output ports available, the framework for expansion is already in place.

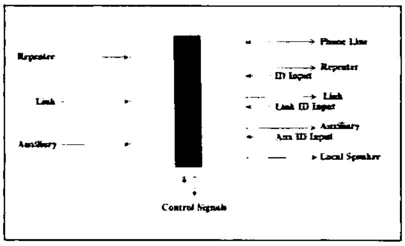

Figure 1. Audio board block diagram.

Audio Board Parts List

C1,11	0.047 µF ceramic	Digi-Key P4521
C2,7,14	0.1 µF ceramic	Mouser 140-CD12R6-104Z
C3,4,5,12	0.22 µF ceramic	Digi-Key P4529
C6,10	10 µF, 16V tantalum	Digi-Key P2038
C8	470 µF, 16V electrolytic	Digi-Key P6230
C9	optional	see schematic
C13	220 µF, 16V electrolytic	Digi-Key P6228
C15,16,17	0.47 µF, ceramic	Digi-Key P4533
D1,2	9V, 1W zener	Mouser 570-1N4739A
D3	1N4001	Mouser 331-PG4001
K1	12V DPDT relay, 960 ohm coil	Mouser ME431-ORZ-SH-212L
Q1	2N2222	Mouser 511-2N2222
R1,3,4,14,23,24,26, 27,28,29,30,31, 32,33,36	22k	Mouser 29SJ250-22K
R2,16,17,20,21	10k	Mouser 29SJ250-10K
R5,7,10,11,15,34,35	100k, 20-turn pot	Digi-Key see note #2 below
R6,8,9,12,13,22	100k	Mouser 29SJ250-100K
R18,19	2.2k	Mouser 29SJ250-2.2K
R25	560, 1/2W	Mouser 29SJ500-560
R37	50k chassis pot	Mouser 31VC405
R38	10 ohms	Mouser 29SJ250-10
R39	560 ohms	Mouser 29SJ250-560
R40	optional	see schematic
T1	600/600 ohm transformer	Mouser ME429-7216
U1,2,3	4001BE	Mouser 511-4001
U4,5,6,7	LM358N	Mouser 511-LM358N
U8	LM386N-1	Digi-Key LM386N-1
U9,10,11	4066BE	Mouser 511-4066
U12	100k 10-pin sip resistor	Mouser 266-100K
VR1,2,3	130V MOV	Mouser 570-V130LA1
PCB	double-sided	WB3ESS RCAB9-26-90-2 (see note below)
Card-Edge connector 31/62	Solder eyelet with mounting holes	Digi-Key S1312
Alternate connector	solder tail, no mounting holes	Radio Shack 276-1453

Notes: 1. All resistors are 1/4W unless specified otherwise. 2. For side adjust pots, order part number CFG15; for top adjust pots, order CEG15. 3. If IC sockets are used, be sure to purchase sockets that have long enough leads so that the traces under the sockets can be soldered on the top surface of the board. 4. Parts are available from Digi-Key Corp., 701 Brooks Ave. S., P.O. Box 677, Thief River Falls MN 56701-0677. Tel. (800) 344-4539. Mouser Electronics, 12 Emery Ave., Randolph NJ 07869. Tel. (800) 346-6873.

Etched and drilled microprocessor and audio PC boards are available for $19 each from John Bednar WB3ESS at 548 Cherryville Road, Northampton PA 18067. John can also supply a pre-programmed 8749H microcontroller IC for $19 (please indicate the repeater call as you want it sent, including the prefix "de" and suffix "/rpt" along with all spaces clearly marked). A limited supply of SSI202 touch-tone decoder ICs are available for $7. Please add $4 shipping for all orders. Foreign orders should include additional postage.

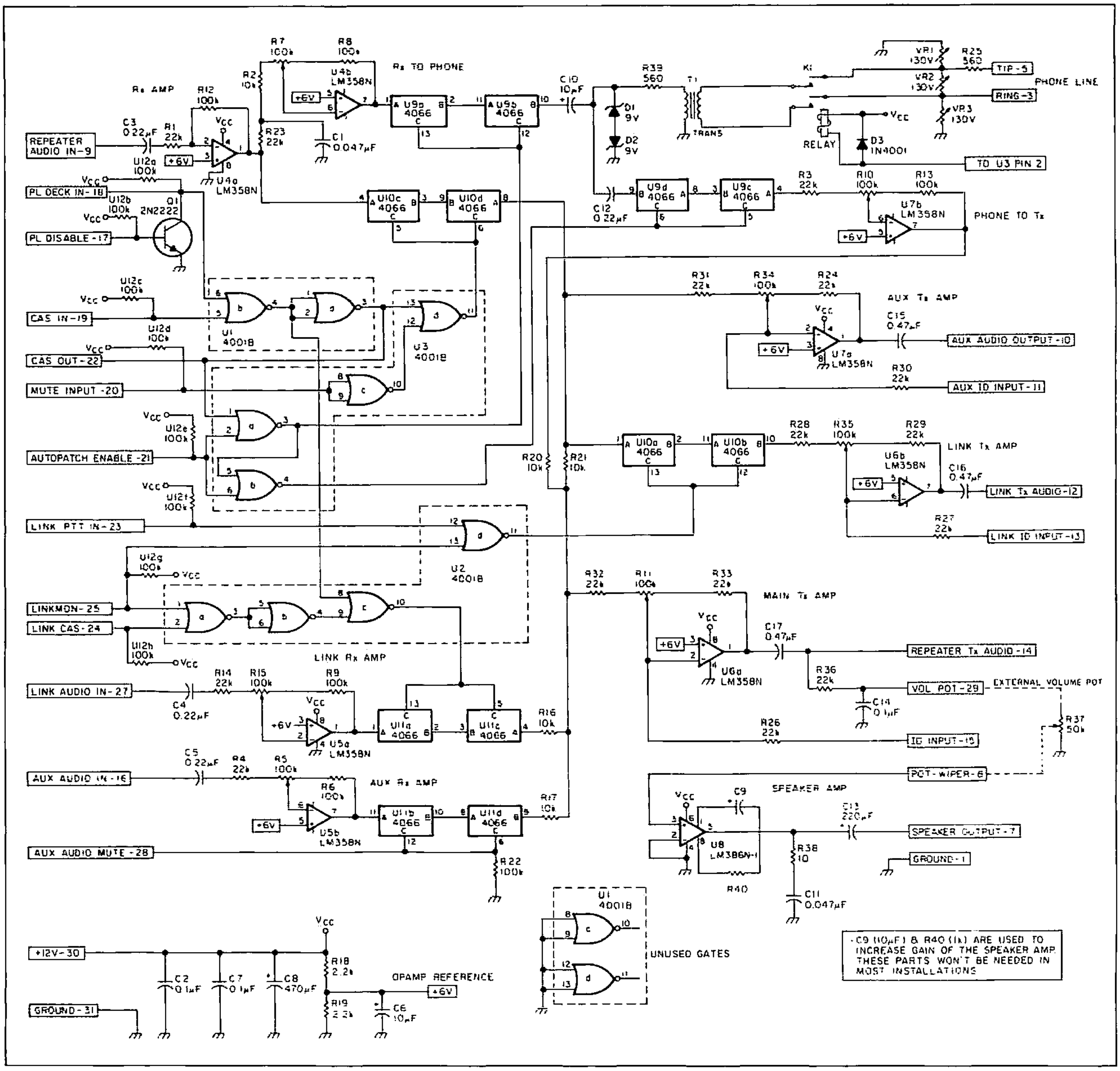

Figure 2. Schematic for the audio board.

For those repeaters without PL, pin 17 on the audio can be left disconnected and the repeater will function normally. To install PL on the repeater, connect an open collector output from a PL deck to the PL DECK IN pin of the audio board and a computer output to the PL DISABLE pin. Apply power, ground, and audio to the PL deck and the installation is complete. Remember, output #9 is ideal for this because the courtesy beep changes to let our users know that PL is required to use the repeater. When the repeater controller initially powers up, the computer board outputs are HIGH; therefore, PL will not be needed to initially operate the repeater. When the output is programmed low, the PL deck output will be gated with the receiver CAS to derive the CAS OUT signal for the computer board. When enabled, PL will be required for all repeater operation, including the entry of DTMF commands.

The speaker amplifier has an output power of approximately 0.5 watts into 8 ohms. Several owners have noticed that some LM386N ICs are unstable if the device input isn't connected to the volume control. Therefore, if you don't plan to use the speaker output, don't bother installing IC U8. The volume control (R37) is not located on the audio board because it's intended to be installed at a convenient location for speaker level adjustment.

How It Works

Although the audio board has many audio paths, its operation is fundamental. All op amps operate around a +6 volt DC reference applied to the noninverting pin of each amplifier. Capacitors are used at almost every input and output to interface to receivers and transmitters. An exception to this are the three ID inputs where external coupling capacitors *are* required. The computer board used one of these ID inputs, however the coupling capacitor is already present on that board.

The primary audio path is from the repeater receiver through to the transmitter. The main repeater receiver audio is connected to pin 9 of the board. Input amplifier (U4A) has a fixed gain of 4.5 which can be changed by varying resistor R12. The receiver audio is then passed through two series audio gates (U10C and U10D) which are controlled by three signals (the CAS IN, the MUTE signal from the computer board, and the PL DECK IN signal). Whenever the voltage is near zero on the control pin of any audio gate (pins 5 and 6 here), the audio is muted or switched off. When the audio passes through the audio gate (U10C and U10D), it then goes to three amplifiers (U6A, U6B, and U7A) and the speaker amplifier U8. Each output has an

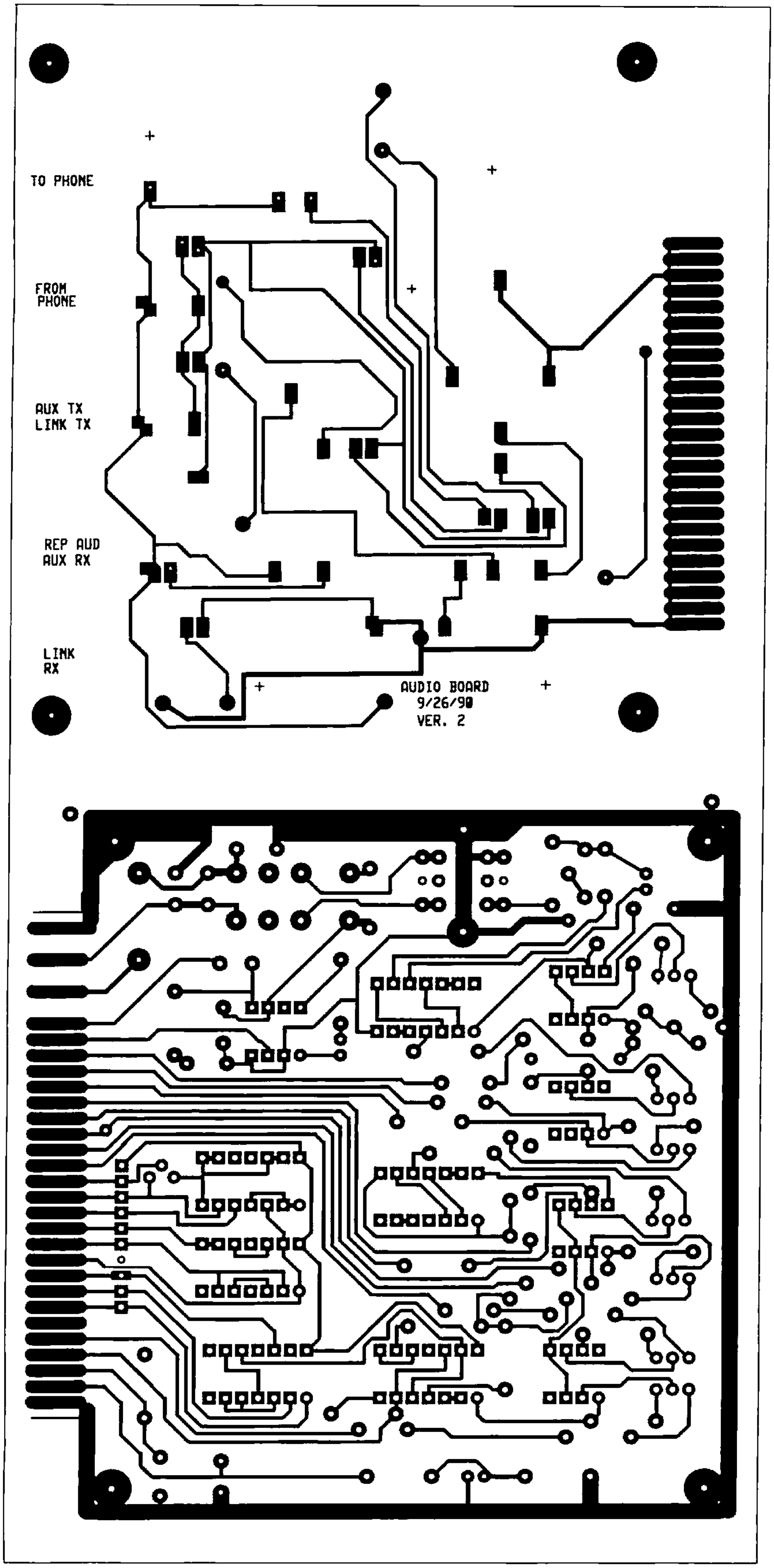

Figure 3. PC foil patterns for the audio board. (a) Top layer. (b) Bottom layer.

individual gain adjustment so each one can be adjusted separately.

The receiver audio from the input amplifier (U4A) also passes through an RC filter (R23/C1) to the adjustable phone amplifier (U4B). The gain of this stage is controlled by pot R7. If needed, the gain can be increased or decreased by changing the fixed resistor R8. The audio from op amp U4B is then passed through an audio gate to the telephone transformer. This audio gate is controlled by the receiver CAS IN signal, and the AUTOPATCH ENABLE from the computer board. When both the CAS OUT and the AUTOPATCH ENABLE signals are LOW, the audio from U4B is passed through to the telephone. Audio from the telephone is gated by U9C and U9D before passing to op amp U7B. The output of this op amp is connected to the main transmitter mixer which feeds the repeater transmitter and local speaker. The phone line is connected to the audio board with relay K1. It is controlled by the AUTOPATCH ENABLE signal. The audio board phone interface is protected by the 130 volt MOVs (VR1, VR2, and VR3), zener diodes (D1 and D2), and resistors (R39 and R25).

The remaining audio inputs LINK AUDIO IN and AUX AUDIO IN are similar to the repeater input, only differing in what controls the gate pin of the audio gates. Both of these inputs have an adjustable amplifier with individual pots. Similar to the other stages, the gain can be varied further by changing the fixed feedback resistor (R9 and R6) in each stage. The audio from these inputs is connected to the main transmit mixer.

The speaker volume pot is connected to the output of the main transmit op amp U6A. An RC filter (R36 and C14) is provided to roll off the audio for a natural sounding response. If necessary, capacitor C14 can be varied to make the speaker audio sound pleasant. The wiper of the volume pot feeds the speaker amplifier (U8) which can drive an 8 ohm speaker. Holes are provided in the circuit board for additional components (R38 and C11) to increase the gain of this speaker amplifier if necessary. I don't think these parts will be necessary in most installations.

Assembly

Before you begin assembly, here are some tips:

- Use a LOW TEMPERATURE soldering iron. Do not attempt to assemble this board with a high temperature soldering iron or gun.
- Like the computer board, watch out for an incorrect resistor SIP.
- You cannot install the telephone transformer and the MOVs backwards.
- All traces must be soldered on both sides of the board. The holes are not plated through.

Begin assembly by installing the components that have traces on the top side of the board. If sockets are used, make sure you leave enough room under the socket to solder the top board pads. Next, install the two jumpers. One jumper is near R1 and the other is near the common end of resistor pack U12.

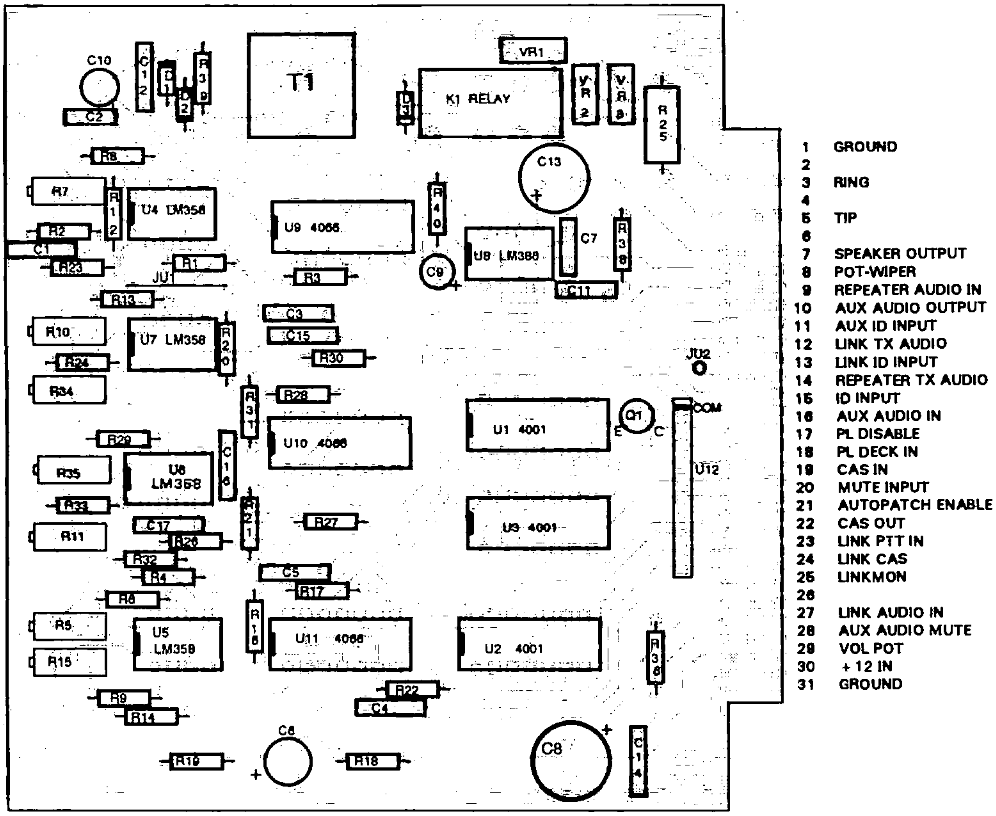

Figure 4. Parts placement for the audio board.

Complete the board by installing the remaining components.

Adjustments

See the diagram in Part I in the October 1991 issue. It shows the necessary connections to the audio board for a simple repeater installation. For simplicity, power and ground connections to both boards were omitted. The first test is to power up the repeater controller and listen for the power up ID on the speaker or the repeater transmitter. If necessary, the ID level may be adjusted with R20 on the computer board. Next, adjust the audio path from the repeater receiver through to the transmitter with R11. If there isn't enough gain, increase the feedback resistor (R12) of U4A to about 330–500k ohms. If too much audio is the problem, an external resistor divider should be used to pad down the level.

Once the main repeater path is adjusted properly, the ID level can be readjust-

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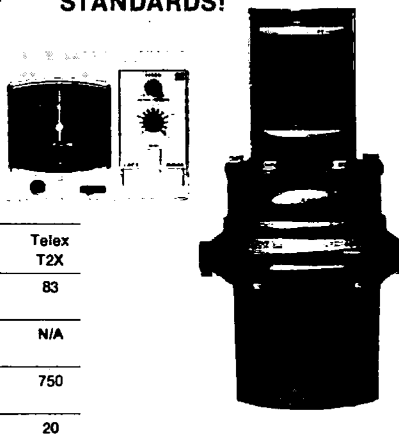

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Rotate Torque F/#	37	50	57	143	215	287	67	83
Gd²KgM² Ant Inertia	100	400	700	1000	1800	3000	N/A	N/A
Brk/Static Torque F/#	215	502	717	1290	1792	2150	417	750
Wind Load In Tower(8)	11	22	27	27	33	36	15	20
Mast Mount	5	9	12	12	15	16	7.5	10
Rotating Speed 360°	55	35	65	40	77	80	60	60
Power 120V 60Hz	70VA	70VA	70VA	90VA	120VA	150VA	26V AC	26V AC
Mast Dia.	1.2-2.4 in	1.6-2.4 in	1.6-2.4 in	1.6-2.4 in	2.4-3.1 in	3.5-5.5 in	2 in	2 in
Vertical Max Load#	660	1100	880	1760	1760	2200	400	800
Rotor Wt/#	7.5	9	11	11	13	39.5	24	28

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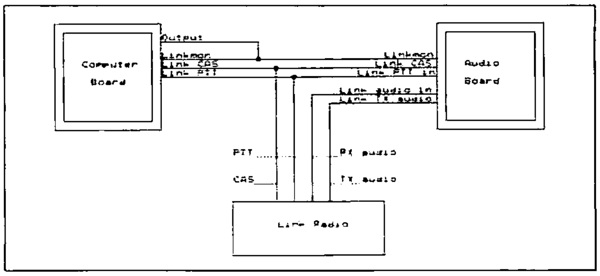

Figure 5. Block diagram of modifications to add a basic link to the repeater controller.

ed to the correct level. Follow this by adjusting the DTMF decoder level on the computer board. To set this level, simply transmit a DTMF digit and turn R17, on the computer board, 20% past the point where LED DS1 lights. If you notice that some digits light the LED and others don't, try increasing the level a little. If the increase in level doesn't help, the frequency response from the receiver isn't proper. On the computer board, try removing one end of C8 and/or C18 to see if an improvement in decoding can be made. If the operation gets worse, the values of C8 and/or C18 may have to be increased. If additional gain is needed for the DTMF amplifier, the value of R18 can be lowered to increase the gain. For reference, the SSI202 touchtone decoder will function with 15–20 mV rms of audio. This was measured from U3, pin 9, to ground while transmitting digit #1.

At this point, the repeater should function and DTMF commands may be entered. The final adjustments on the audio board involve setting the autopatch levels. Turn on the autopatch and adjust R10 for proper level from the phone line to the repeater transmitter. Next adjust R7 for proper levels to the phone line. If either adjustment is out of range, increase or decrease the appropriate feedback resistor (R8 or R13), to vary the the gain of the op amp. This should complete the adjustments necessary for a repeater with autopatch.

If the link or auxiliary ports are used on the audio board, the adjustments are identical to what has previously been done. Remember, the feedback resistor in each stage can be changed if needed. Before adjusting link audio, the LINKMON input will have to be pulled LOW for the audio gating to work properly. Also, the auxiliary audio input has a control signal which is connected to pin 28. This pin will have to be pulled HIGH (12 volts) for audio to pass through the audio gate directly after the op amp.

Adding Links

There are two methods of adding a link to this repeater controller. The first method is simple and requires little extra hardware, while the second method offers many advanced features, like being able to activate the link from the link frequency! This repeater controller was optimized for a single

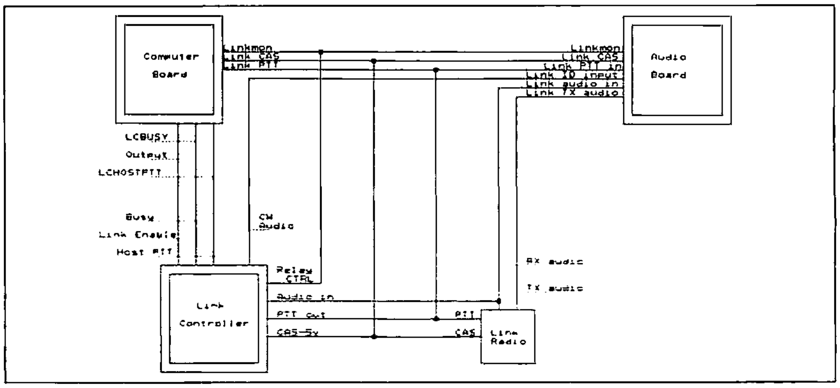

Figure 6. Modification for an improved link installation.

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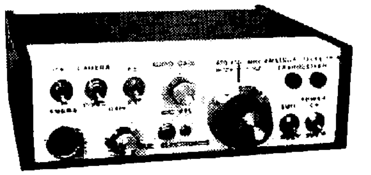

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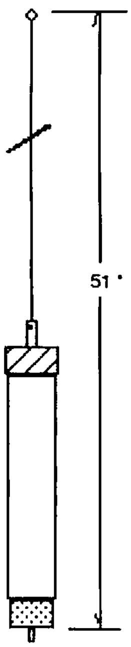

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link or remote base. Adding multiple links is possible, but the external hardware must be built to switch the control and audio signals.

To add a simple remote base to the basic repeater, see Figure 5. There are only a few extra connections that have to be made to add this type of remote. A small amount of interfacing may have to be done to connect the PTT and CAS lines to the repeater controller. Although this is very attractive, the link can only be turned on and off from the repeater, plus there will be no ID on the link frequency. Also, before using the autopatch, the link will have to be turned off manually.

With some extra hardware, the link installation can be upgraded to address all of the above concerns plus add more features. This method incorporates the Link Controller, a previous project which appeared in the December '89 issue of *QST* ("A Repeater Linking Controller"). To make interfacing to the Link Controller easy, this repeater controller has several dedicated outputs. A diagram of this type of link can be found in Figure 6. Similar to the previous figure, it only shows the connections that have to be added to the basic repeater diagram. With only a few extra connections and a Link Controller board, the simple link can be upgraded to add features not found on the kilo-buck repeater controllers.

Ideas and Expansion Circuits

This section is a combination of ideas and suggestions for expanding the repeater controller. Some of these ideas have come from owners using the controller. I invite others to expand on these topics and submit their circuits to *73 Magazine* for others to use.

• A simple timer circuit may be built to add an autopatch timer to the repeater controller. Input #2 provides a way to remotely terminate the autopatch.

• Similarly, a long distance lockout circuit can be constructed to terminate the patch if a long distance number is dialed. An output pin from the computer board can be used to defeat this feature when long distance dialing is allowed.

• The superuser input pin on the computer board can be connected to a variety of sources. One interesting idea is to connect it to the output of a PL decoder. The owner would turn on PL while transmitting to enter superuser commands. Really sneaky, huh?

• If an output pin is connected to the superuser pin, an input pin can be connected directly to the superuser pin for a status readback of the DTMF priority. That way, owners can prompt the repeater controller to see what mode the controller is in.

• If the repeater doesn't have a link, the link courtesy beep can be used by connecting an unused output to the LINKMON input. By programming the output low, the link courtesy beep will be turned on. At the same time, the link PTT pin from the computer board will become active. This output can be used to key a PL encoder. With this connection, PL will be encoded on the repeater when a user is transmitting. Great for those handhelds that decode PL.

• The MUTE output from the computer board can be used to key a DTMF cover tone oscillator. The output of this oscillator can be fed into the ID INPUT on the audio board.

• The MUTE output signal with some logic can also be used to unkey the link transmitter while touchtones are being entered.

While writing this manuscript, I quickly became aware that this wasn't going to be a short article. In addition to what has already been presented here, I have generated two additional documents. One describes the controller commands in more detail, while the other provides a detailed functional pin-out description of each board. *[See author's address below.]*

I would like to acknowledge two people who assisted in this repeater controller project. Gary N3ECW coordinated the manufacture of both circuit boards, assembled all PC board models, and evaluated the performance of the completed audio board. In addition, Mike N3DZM provided considerable input during the design phase of the audio board. He also built the hand-wired audio board prototype, debugged it, and made the first repeater installation of this controller. Since a project like this takes so much time to complete, without Gary and Mike's help, it would certainly have taken much longer. ■

You may write John K. Bednar WB3ESS at 548 Cherryville Road, Northampton PA 18067. Please enclose an SASE for a reply.

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Brk/Static Torque F/#	506	1085	1450	417	750
Wind Load In Tower (8)	10	25	25	15	20
On Mast (8)	4	5	7	7.5	10
Speed 360°	60-150 sec	60-150 sec	60-150 sec	60	60
Rev. Delay	None	2 sec	3 sec	None	None
Preset	Opt 3	Opt 3	Yes	No	No
Power 120V 60Hz	80VA	140VA	200VA	26V AC	26V AC
Mast Dia.	2-2.5 in	2-2.5 in	2-2.5 in	2 in	2 in
Control wire	7 cond	7 cond	7 cond	8 cond	8 cond
Vertical Max Load#	880	1540	1540	400	800
Rotor wt/#	13	17	20	24	28

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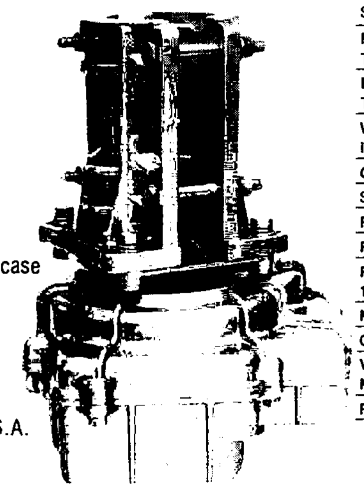

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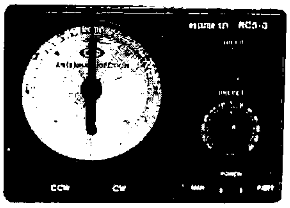

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A Simple 10-Meter Sideband Amplifier

Give your QRP rig a boost.

by Bruce Auld NZ5G

This sideband amplifier project is intended as a sequel to "A 10M Sideband Transmitter" (*73 Amateur Radio Today*, October 1991, page 14). It will give the rig a fighting chance among the crowds that we experience, even on 10 meters.

This amplifier generates between 5 and 10 watts PEP on 10 meters, depending on the input power, using a single 2SC1969 transistor, which is an inexpensive plastic device. In my version of the amplifier, 10 watts was available with an input of about 1.25 watts. When input power drops to 0.75 watts, the output drops to about 5 watts. The transmitter this is designed for should deliver between 0.75 and 1.0 watts PEP, depending on construction methods and the parts used.

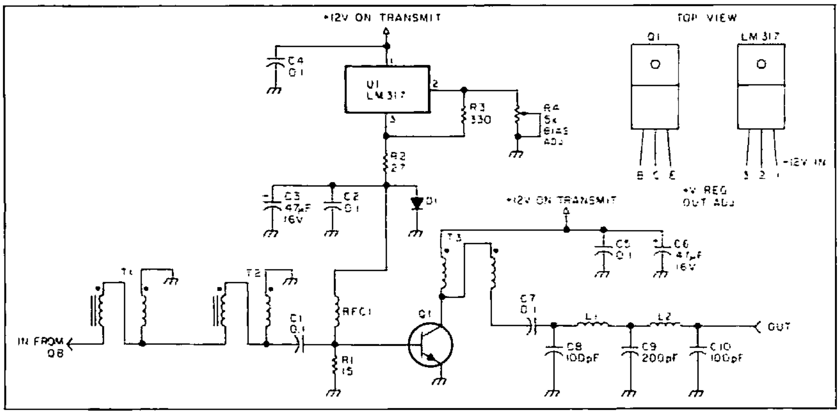

Figure 1. Schematic diagram of the amplifier.

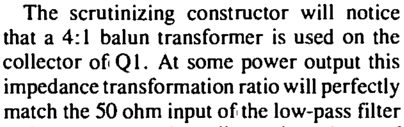

Figure 2. If you don't use an etched PC board you can make your own mounting pads and solder them to blank PC board material as shown.

Figure 1 is the schematic diagram of the amplifier. It is intentionally broadbanded, with two cascaded 4:1 transformers at the input to step the impedance down, and one 4:1 transformer at the output (see Figure 6 for winding details of T1, T2 and T3). The only components which are frequency-dependent are the LC combinations which make up the low-pass filter at the output. If you would like to construct this amplifier for other bands, only the low-pass filter components LI, L2, CI, C2 and C3 need to be changed (see Table 1).

The necessary forward bias for Q1 (0.7 volts) is set by D1, a garden-variety rectifier diode. I chose to use the LM 317 adjustable voltage regulator to drop the 12 volt supply down to around 5 volts before feeding it to the diode. Some circuits call for a single power resistor of 100 ohms or so in place of U1, but it must be rated at 10 watts or more because it dissipates a tremendous amount of heat. The circuit I used stays quite cool.

The scrutinizing constructor will notice that a 4:1 balun transformer is used on the collector of Q1. At some power output this impedance transformation ratio will perfectly match the 50 ohm input of the low-pass filter and the antenna. The collector impedance of this type of circuit is found by the following formula: $\mathbf{Z = Vcc^2 / 2 \cdot PO}$, where **Z** is the impedance, **Vcc** is the supply voltage, and **PO** is the power output. Applying the formula to the power outputs possible, you will see that at 5 watts, collector impedance is 14 ohms; and at 10 watts it is 7 ohms. Consequently, if the amplifier is to run at a power higher in the range specified, a 9:1 transformer may better match the collector to the low-pass filter. As a practical matter, I have tried 4:1, 9:1 and 16:1 transformers at this point with equal result. Solely for the sake of simplicity, I chose the former. Your application may justify another transformer.

Construction

Construction is performed over a ground plane of printed circuit board material, cutting out a small rectangular hole to accommodate the body of Q1. In my version of the amplifier, Q1 is mounted against the back wall of the transmitter, which acts as a heat sink. Because the tab of the transistor is common to the collector, insulate it from the chassis with a mica wafer. Do not forget silicon grease at this union to enhance heat transfer. I used the "ugly" construction method, mounting components on top of the board between half-inch square islands of double-sided PC board material affixed to the board. These pads can be fashioned easily with a hacksaw or hobbyist's drill with a cutting wheel, then soldered on the board, first by tinning the underside of the pad and its site on the board. Next, lay the soldering iron on the site to heat it and hold the underside of the pad on the topside of the soldering iron. When both surfaces are hot (two seconds will do), quickly remove the soldering iron and lay the pad on its site. The joint cools almost instantaneously and forms a permanent bond. I found that temporarily soldering a half-watt resistor to the top of the pad makes a nice "handle" for easy manipulation of the pad and precise placement on its intended site on the board (see Figure 2).

While I preferred not to use the conventional ferric chloride etching technique, those desiring an etched board may prepare the board by masking the entire board with tape or rubber cement and carving out narrow borders around the pads, exposing them to the etching solution. Figure 3 shows the foil pattern of the board and Figure 4 is the parts placement guide. A layout similar to this was

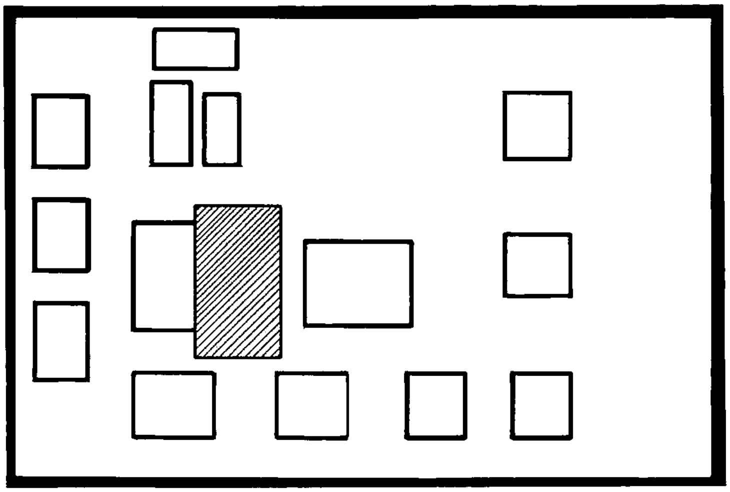

Figure 3. PC board foil pattern. Note: Dark lines are etched areas.

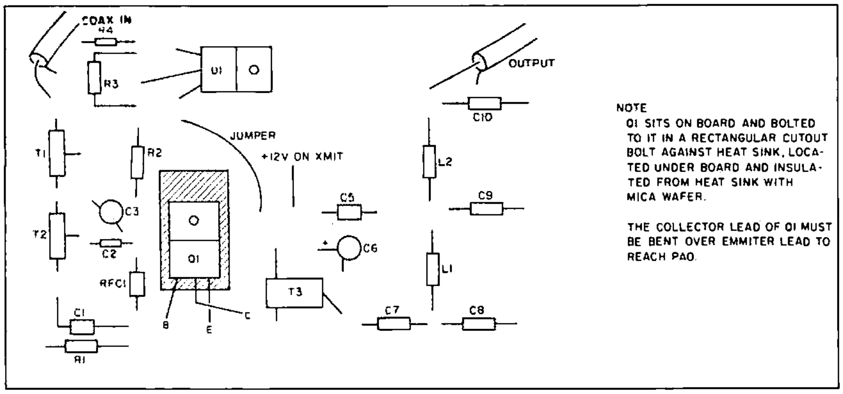

Figure 4. Amplifier parts placement. Cut out the shaded area of the PC board under Q1.

described in detail by Bill Heishman in his article "MOuSeFEet" (*73 Amateur Radio Today*, November 1990, page 36), with a full-size etching pattern. It is easily adapted to this purpose.

The supply voltage may be applied to the collector of Q1 continuously because the transistor is turned "off" until bias (from U1) and RF drive are applied. Consequently, the bias voltage is applied only during transmit periods. This keyed voltage may be obtained from relay K1 on the transmitter amplifier board. There is a PC solder pad and hole for this purpose.

In order to place the amplifier "in service," you must decide whether to leave it in-line permanently, or whether you want the option to switch it in and out to achieve high and low power output for your transmitter. If you prefer it in-line continuously, simply route the transmitter output (after the low-pass filter, but ahead of the antenna relay) to the amplifier, and the output of the amplifier to the relay. It is as simple as adding another stage of amplification to the transmitter. If you prefer selectable power levels, install the amplifier the same way, but include a double-pole, double-throw toggle switch between the transmitter low-pass filter and the amplifier input, as described below (see Figure 5).

Tune Up and Operation

Tune up and operation are simple. First, with transmit voltage applied to U1, but no RF drive, adjust the voltage appearing at pin 3 of U1 to approximately 5 volts. Next, confirm that D1 is properly limiting the voltage at the base of Q1 to 0.7 volts. Apply drive from the transmitter and check the output with a wattmeter. As with the transmitter, squeeze together or spread apart the turns of coils L1 and L2 in the low-pass filter of the amplifier for highest output.

I noticed that the system as a whole was less tolerant of impedance mismatches between stages and imprecise adjustments in the various stages in general. Oscillations appeared in the transmitted signal that were not present at the 1 watt level that originated in the transmitter. This glitch disappeared by making more precise adjustments in the transmitter. I recommend reducing audio drive with R27 and reducing the input to the mixer by rotating Q5's trimpot, R15. Also, readjust all the

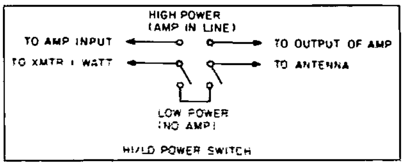

Figure 5. A double-pole double-throw switch can be used to switch the amplifier in and out of the circuit.

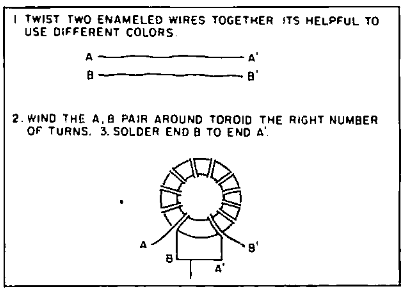

Figure 6. Bifilar winding details for T1, T2 and T3.

Table 1. Output filter values for other bands.

Band (meters)	C1,C3	C2	L1,L2
12	117 pF	220 pF	8 turns, T-50-6 toroid
15	138 pF	270 pF	9 turns, T-50-6 toroid
20	138 pF	420 pF	12 turns, T-50-6 toroid
30	289 pF	579 pF	12 turns, T-50-2 toroid
40	400 pF	800 pF	14 turns, T-50-2 toroid
80	700 pF	1415 pF	19 turns, T-50-2 toroid

Note: use #26 wire for C1 and C2. Use capacitors that are closest to these suggested values. As the operating frequency decreases, the gain will increase as well as the possibility for instability. You may have to use RC feedback to negate this effect. Values for the above table were obtained from the QRP Notebook by Doug DeMaw.

trimmers in the completed transmitter to achieve a good balance in the system as a whole. Listen to your voice in the station receiver and you will be rewarded with a cleaner signal.

On-the-air tests were gratifying. While true QRP operation is a lot of fun, a little punch in your signal will enhance its readability and produce longer and more enjoyable contacts. I found that contacts with armchair copy were easy to make. Of course, it's always the best policy to use less power when it will suffice, but no one will suggest you are using overpower on the ham bands at 10 watts! Happy home-brew DXing! ■

Table 2. Parts List

Part	Description
U1	LM317 variable voltage regulator
Q1	2SC1969 power transistor
RFC1	10 turns on an FT-37-43 toroid
T1,T2,T3	10 turns #26 wire, bifilar wound on an FT-50-43 toroid (an FT-37-43 can be used for T1 & T2)
D1	1N4001 rectifier diode or equiv.
L1,L2	8 turns #26 wire on a T-50-6 toroid
C1,C2,C4,C5,C7	0.1µF/50V ceramic capacitor
C3,C6	47µF/16V electrolytic capacitor
C8,C10	100 pF ceramic capacitor
C9	200 pF ceramic capacitor
R1	15 ohm resistor
R2	27 ohm resistor
R3	330 ohm resistor
R4	5k PC mount potentiometer

An etched PC board is available for $6 + $1.50 shipping per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

Toroids and other components can be obtained from Tanner Electronics, 1301 West Beltline Rd., Suite 105, Carrollton TX 75006. Tel. (214) 242–8702. Radiokit, P.O. Box 973, Pelham NH 03076. Tel. (603) 635–2235. Circuit Specialists, P.O. Box 3047, Scottsdale AZ 85271-3047. Tel. (800) 528–1417 and RF Parts, 1320 Grand Avenue, San Marcos CA 92069. Tel. (619) 744–0700.

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The 4066 IC

Several months ago, I mentioned using a 4066 IC for audio muting in the HW-9. This IC was put to good use by Paul Levesque KB1MJ. It occurred to me that many people who design their own gear might not know about this very versatile chip.

So, just what is a 4066, anyway? Well, it's a quad analog switch. Basically, it's just four CMOS switches that can be turned on or off by putting a voltage on a control line. With zero volts on this line, the switch is open. Apply more than half the supply voltage on the control line, and the switch turns on. The "on" resistance is anywhere from 80 to 270 ohms.

The 4066 can pass DC for switching, RIT circuits, and, of course, relays. The 4066 can also pass audio with low distortion, and handles RF up to 40 MHz. You can switch it on and off up to 10 MHz. The low current demands make this a QRP potable rig-builder's dream come true—only 0.5 microamps. The peak switching voltage must not be higher than the supply voltage, however. There are current limits flowing through the switches.

Since there are four switches in one 4066, any leftover switches can be used to control other circuits instead of transistor switches. Relay drivers and LEDs come to mind. If you don't need them for this, you can wire up the leftover switches in parallel for more current capacity. You might want to do this if you use a T/R relay with a coil resistance under 300 ohms.

The 4066 IC might be the chip you're looking for if you're into QSK transceivers. A pair of small reed relays could do all the RF switching, with the 4066 doing the DC and audio switching.

Because the 4066 is a CMOS device, it is easily damaged by static unless buffered. Most of the CMOS chips made today are buffered, but beware of the surplus ICs, and, of course, ICs from old computer boards. Keep static away from the chip, and you'll have no trouble. Also, with any CMOS chip, all unused inputs should be tied to either ground or Vcc. Don't let them float!

The 4066 can be purchased for about 60¢. Radio Shack stocks the 4066 at a slightly higher price. See Figure 1 for various uses of the 4066.

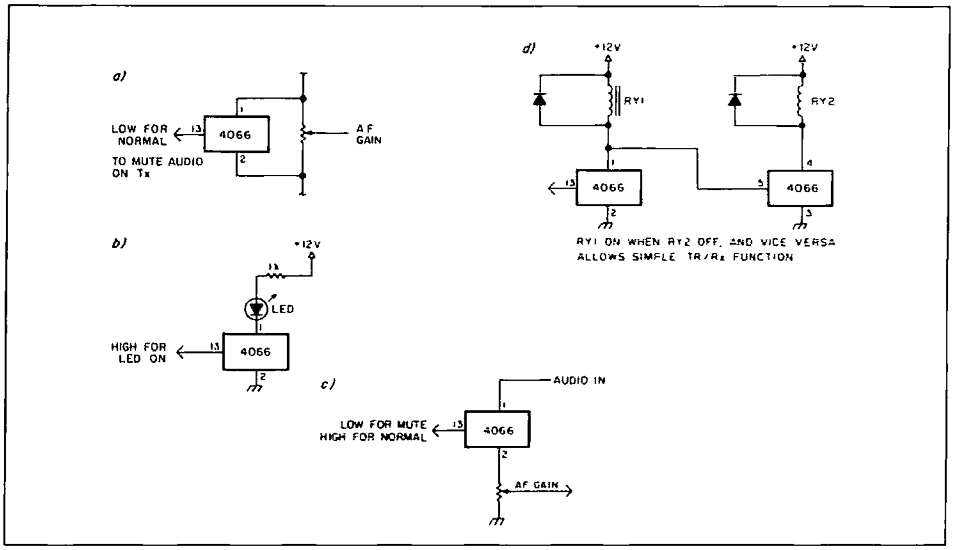

Figure 1. The 4066 IC can be used in a number of ways.

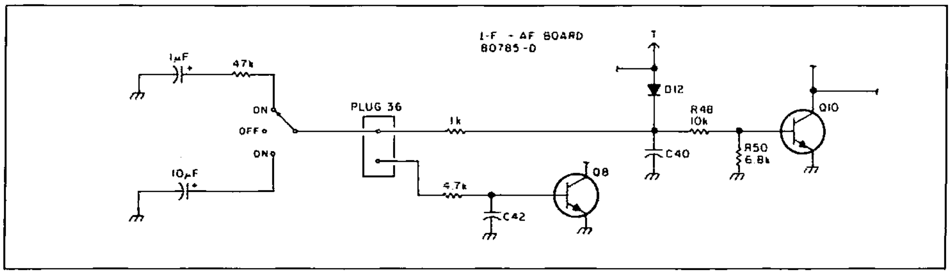

Figure 2. The break-in delay for the Argosy is determined by C40 in the AF-IF board.

Argosy Break-In Delay Mods

In the past, I've had modifications for the Heath QRP rigs. Now I've got several this month for the Ten-Tec Argosy.

Anyone who has used the Argosy knows that there is no RF gain control. But don't get ahead of me—this isn't a modification to add either an RF gain control or RF attenuator. Instead, this modification slows down the QSK during periods of high QRM or QRN. It would be especially helpful during a CW contest. The "thumping" in the headphones is greatly reduced with this modification (see Figure 2).

The modification gives three types of break-in delay: A slightly extended break-in to reduce the "thumping"; normal, full break-in; or the semi-break-in delay, as used on the Corsair.

The break-in delay is determined by C40 in the AF-IF board. This is a 1 µF electrolytic capacitor. Also on this board is plug 36, which has a spare unused pin.

To carry out the modification, first cut the PC trace between the two pins of plug 36. Solder a 1k ohm resistor from the positive end of C40 to the unused pin on plug 36. This resistor should be on the underside of the board.

Drill a 1/4" hole on the rear panel next to the HI/LO power switch. A small toggle switch of the ON-OFF-ON type is required. Wire this switch as shown in Figure 2. A large solder lug around the switch's shaft will make a convenient place to ground the required resistors. By selecting the value of the capacitor, you change the delay break-in time constant.

A word of caution. If you don't know what you're doing, don't attempt this modification. Anytime you have to cut traces, be sure to measure twice, cut once! I have not done this modification to my Argosy, so do so at your own risk.

To reduce the amount of RIT offset in the Argosy, here's a simple mod that requires only one additional part—a resistor.

Wire a 15k resistor across the RIT control. This will reduce the offset to about +2.9 kHz to −3.1 kHz. This is a great way to fine tune the RIT; makes it so much easier to tune in a signal when using the narrow crystal filters.

Next month we'll visit the shack of a DXer and QRPer, all rolled into one. The Pulse Charger was such a success that I have made up more kits of the PC board and parts. It's still $29.95 plus $2.50 for postage. It would be a great project for the coming winter months.

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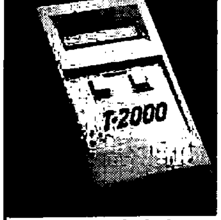

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The Amateur Television Network

What do you do if you are surrounded by 5000-foot (or higher) mountains? You plant ATV repeaters on top of them, of course! In Southern California you're never out of reach of at least one of the many machines that cover the region. Over the past few years a group called ATN (the Amateur Television Network) has been undertaking an ambitious effort to link some of these repeaters together to form a wide-area system.

The first repeater in the network is the WA6SVT machine with an input on 434 MHz (426.25 alternate) and an output on 1253.25 MHz. It is located on top of 5670-foot Santiago Peak. Its location, southeast of Los Angeles, covers most of the Los Angeles basin and the San Bernadino/Riverside valleys, most of the San Gabriel valley, as well as a good deal of San Diego county.

Linking it All Together

Mike K6ZSR and Mark NU6X started a repeater project to fill in coverage in the San Fernando Valley and parts of Ventura County. With an output on 919.25 MHz, it was the first repeater (of any kind) to use the new 900 MHz band. It's located on top of Oat Mountain, near Chatsworth. The Oat machine was the first to be linked up to Santiago Peak (although it's currently a one-way link from Santiago). The Oat machine operates as a normal ATV repeater if someone is transmitting on its 434 MHz input. If the Oat repeater is idle and the Santiago repeater is up and running, a 1253.25 MHz receiver at the Oat Mountain site links this to Oat's output on 919.25 MHz. That way anyone in the San Fernando Valley can watch what is going on in the rest of the ATN system.

The third repeater in the network is the WB6VVV/WA6SVT machine on Job's Peak (near Crestline) high above San Bernadino. This machine uses the same 919.25 MHz output as the Oat repeater. A number of mountains (as well as a fair distance) separate the two machines, so there is no interference problem. This machine is a key factor to linking into the Mojave Desert and beyond. Not only can it be linked to the Santiago Peak machine (in the same manner as the Oat repeater), but an ambitious project has been undertaken to use this machine to link all the way into Las Vegas, Nevada!

The Las Vegas Connection

Geoff KB7BY (along with encouragement and help from Mike WA6SVT and area ATVers) installed the Las Vegas ATV repeater at the 8500-foot level of Mt. Potosi (just west of Las Vegas). The output is on 1253.25 MHz with a primary input on 434 MHz (AM-TV) and an alternate input on 913.25 MHz (FM-TV).

From his mountaintop home at Crestline, California, Mike WA6SVT could access the Mt. Potosi machine quite regularly, even though it was 200 miles away! Linking Las Vegas with the Los Angeles area looked like a possibility. Since a direct hop was quite weak most of the time, an intermediate relay site was needed.

Rodman Mountain turned out to be the ideal site for the relay. Even through it's located 48 miles from the WB6VVV machine at Crestline, and over 110 miles from KB7BY/r at Mt. Potosi, the reception at Rodman was good from both repeaters.

The Rodman Relay

The Rodman relay site is rather unique. With two receivers and two transmitters, it operates as a full-duplex dual-direction link. To relay video from Mt. Potosi down to California, the Rodman site has a 1253.25 MHz receiver which constantly monitors the output of the KB7BY repeater. This is relayed back to Job's Peak machine via a directional 1289.25 MHz FM-TV transmission.

To send video back to Mt. Potosi from the Job's Peak repeater in California, the Rodman site monitors a 33cm link and relays it to Mt. Potosi via another 1289.25 MHz FM-TV transmitter. To receive the Rodman relay, FM ATV receivers are located at both Job's Peak and Mt. Potosi.

Since the Rodman transmit antennas are pointed in different directions, the capture effect of FM-TV allows the use of the same frequency (1289.25 MHz) in both directions!

Priorities and Control

OK, sounds good, but how do you activate the link? You don't; it operates automatically. The link video is always available at the repeaters on each end of the path. All the repeater controllers at Mt. Potosi and Job's Peak do is choose which video signal to repeat.

This is done with a custom repeater controller that is installed in each ATN repeater. Here's how it works: The controller monitors up to eight sources of video. These can be from the demodulated output of different input frequencies, the Rodman link, a video ID, or even a local feed (such a satellite dish tuned to NASA Select). The controller prioritizes each video input port. If just one video source is active, then it gets repeated out. If two or more signals are active at the same time, the controller sends out the video with the highest priority.

For example, you can set up 434 MHz as your primary input, 913.25 MHz as the secondary, the link next, and finally a computer video ID. As soon as any local activity stops, anything coming in from the link receiver comes on line. When all activity stops, your repeater ID comes up. You can even set it up so that a control operator can redefine the priorities via a remote command. This would be useful if you want the link to be the primary signal for special nets.

Most ATN repeaters have another interesting feature. Whenever something comes in on a link frequency while local stations are using their repeater, the link signal is inserted into the local picture as a "picture-in-picture". Although this feature can be turned off, you never have to miss what's going on in the rest of the system.

The current system has the potential to allow ATVers over 400 miles apart to work each other. For those of you who live in the flatlands, this is definitely what you would call a significant band opening!

Photo B. Bill KB6MCU tests the WA6SVT ATV repeater on top of 5670-foot Santiago Peak.

Photo C. Geoff KB7BY adjusts the 23cm antenna which helps link the Mt. Potosi, Nevada ATV repeater into Los Angeles.

Linking up the Southwest

Future links are being planned as more and more mountaintop ATV repeaters sprout up across the Southwestern U.S. Some of you may be familiar with the linked systems of voice repeaters such as the ZIA connection, Cactus and the Condor system. Using a combination of these systems, I've been able to talk from El Paso, Texas to Santa Barbara, California (over a thousand-mile distance) from my 2m mobile rig to a friend on the beach on his HT! Believe me, it's quite fun to hear dozens of quick kerchunks as the stacked up repeaters drop out.

Using a series of 900 MHz, 1.2 and 2.4 GHz FM-TV links, a number of ATN machines will be linked up in the near future (see the figure for a map of all known ATV repeaters in the Southern California region). Work is currently underway to link from Los Angeles up to the N6VLV/WA6SVT repeater in the Tehachapi range east of Bakersfield.

There may even be a future link on up to the WA6YLB Blue Ridge repeater

Photo A. Some of the members of the Amateur Television Network (ATN).

east of Fresno. Just one more hop could take them all the way up to Sacramento and the San Francisco Bay area. To the west, Rod WB9KMO will be linking in from his Gibraltar Peak machine (as well as the K6TZ Santa Cruz Island link) above Santa Barbara.

To cover the area north of the San Fernando Valley, Dave WA6ZVE plans to link with ATN from his Loop Canyon machine. And to complete coverage in the Mojave Desert, Mark WB7AJC has his machine on top of 8400' Frost Peak near Wrightwood. Also in the future, there is interest from ATVers in Phoenix, Arizona (the AAA5 group), and some in Utah, in linking into the ATN system via Mt. Potosi.

ATN Activities

Lest you think that this might be too much for the ATN group, they are very experienced at bouncing video around via multiple links and repeaters. For many years, they've covered the annual Tournament of Roses Parade in Pasadena. Some of you may have seen the massive effort they put on during the 100th anniversary of the parade. They had 17 portable transmit sites along the parade route (14 fixed and 2 motorcycle mobiles, as well as W6ORG in his helicopter).

All the sites were linked back to mission control from a rooftop repeater, along with two separate 10 GHz links to tournament control and the public safety center. Not only that, thanks to Dave WA6ZVE, they linked it all up to a commercial satellite so that the whole country could watch the fun (they even arranged an intro about amateur TV by Michael Landon). Other activities that have been covered by the group include the L.A. Marathon, the Angeles Crest 100 race, and several boat races.

To aid in disaster assessment, they have installed ATV antennas in several of the sheriff's department helicopters. In addition, a number of EOC centers have ATV receivers which are tuned into the ATN network. In the event of an emergency, ATN members (in support of RACES) can transmit video from the helicopters which can be viewed at the emegency control centers.

There's plenty to watch on the ATV repeaters in Southern California. They even occassionally link a remote observatory so that astronomy buffs in the greater L.A. region can watch the heavens from clear skies.

You Haven't Seen Anything Yet

If you're in the L.A. area or just visiting, give the locals a listen on their calling frequency of 146.43 MHz. The weekly ATN net meets every Tuesday evening at 8 p.m. They have 2 meter remote bases at each ATV repeater site which allows check-ins from a wide area. This includes ATVers in the Las Vegas area who can not only watch the action, but check in on voice as well using the Rodman link.

If you'd like to find out more about ATN, and help out with future link possibilities, you can contact them at the following address: ATN c/o Mike Collis WA6SVT, P.O. Box 1594, Crestline CA 92325.

More Machines

There are a number of ATV repeaters which are not connected into the system. The K6KMN repeater (434 in/1241.25 out) sits on top of Mt. Wilson above Pasadena. From its vantage point with wide coverage of the L.A. region, this is a good place to look during shuttle missions for live video from NASA. Listen for the Mt. Wilson net on 146.43 every Monday night at 8 p.m.

The Sulphur Mountain group has the WA6UCL (1253.25 out) repeater, which covers Simi Valley and the Ventura area. They have a net every Tuesday night on the 146.88 repeater at 8:30 p.m. In the San Diego area, watch for the WA6VLF repeater (1277.25 out) on top of San Miguel mountain. For those of you north of Santa Barbara, look for the Buellton repeater (K3NXF) in the Santa Ynez valley.

As more and more repeaters spring up across the Southwest, it won't be too long before an ATVer in El Paso or Salt Lake City can link up to watch the sunset over Catalina Island! 73

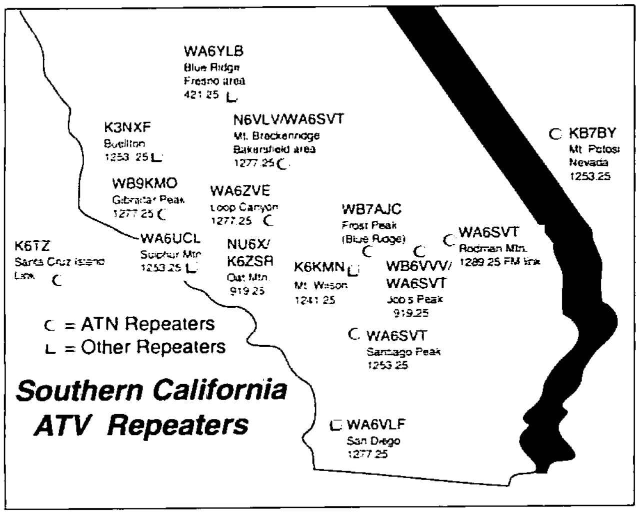
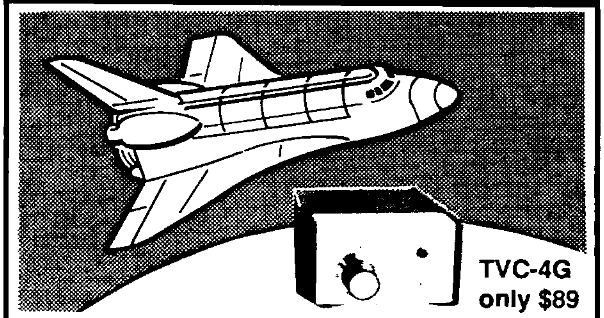


Figure. ATV repeater locations in the Southern California region.

AMATEUR TELEVISION



SEE THE SPACE SHUTTLE VIDEO

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to Satcom F2-R transponder 13. Others may be retransmitting weather radar during significant storms. If it is being done in your area on 70 CM - check page 413 in the 91-92 ARRL Repeater Directory or call us, ATV repeaters are springing up all over - all you need is one of the TVC-4G ATV 420-450 MHz downconveters, add any TV set to ch 2, 3 or 4 and a 70 CM antenna. We also have downconverters and antennas for the 900 and 1200 MHz amateur bands. In fact we are your one stop for all your ATV needs and info. Hams, call for our complete ATV catalog - antennas, transceivers, amplifiers. We ship most items within 24 hours after you call.

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RDF Potpourri

More and more ham clubs are discovering the fun of hidden transmitter hunts, often called "foxhunts" or "T-hunts." To get your group started, all you need is someone to hide the transmitter, and some sort of audio/control unit for the transmitter. Last month's "Homing In" column featured construction plans for TBOX, an easy-to-build tone/ID generator and on/off cycler for hidden T's.

As I indicated last time, TBOX inventor Ron Seese N6MBR has a PC board available. The board layout includes some optional "bells and whistles" that were not part of last month's simple 6-IC project.

By adding a Dallas Semiconductor DS1216C SmartWatch RAM socket and a few other parts to the board, you can program TBOX to start transmitting at any selected day and time. That's perfect for advanced hunts with multiple transmitters.

If you are not going to stay close to your hidden T, you need a way to turn it off remotely, to satisfy FCC 97.109. Ron's board has provisions for an SSI-202 DTMF decoder IC to control it via a link receiver above 222 MHz (FCC 97.201(b)). A 144/222 or 144/440 MHz dual-band rig is perfect for a remotely-controlled 2 meter fox with TBOX.

TBOX's user-friendly firmware is easy to use (Photo A). Ron continues to develop new versions to incorporate these optional features. To find out what's available, send an SASE to him at 6136 Landino Drive, Westlake Village CA 91362.

TBOX Construction Hints

You can use non-CMOS parts at U1 and U2, but power drain will increase significantly and regulator U7 will run much warmer. Bolt a heat sink to U7 if you use non-CMOS parts, or if your TBOX must operate in a hot location.

Dallas Semiconductor's DS1228 RS-232 interface IC is a direct replacement for the Maxim MAX232 at U6. Advanced Computer Products has the DS1228 and all other ICs except U5, plus the crystal. ACP is located at 1310 East Edinger Avenue, Santa Ana CA 92705; telephone (800) 366-3227. U5 is available from N6MBR.

Most mobile and hand-held rigs on the market today require less than one milliamperes to key the PTT circuit. Older transmitters such as the TS-700A use relays that draw more current than Q1 and U1 can supply. If in doubt, use a multimeter to measure the current in your rig's PTT line when you key down.

If PTT current is more than 10 mA, add a reed relay, such as Radio Shack 275-233. Connect the coil between +12V and the collector of Q1. Connect the relay contacts to your rig's PTT circuit. To protect Q1 from voltage spikes from the relay coil, put a 1N4001 diode (RS 276-1101) across the coil. Cathode of the diode goes to the +12V side.

T-Hunting in the Desert

Hams in Phoenix know how to promote their hobby. For example, everyone there knows about the thousands of phone patches that were put through K7UGA's super-station over the years by dozens of dedicated volunteers.

Now another voice is bringing ham radio to the citizens of that area. Len Winkler KB7LPW (Photo B) hosts "Ham Radio and More," a one-hour program devoted to all aspects of our hobby. It airs weekly on KFNN, a 10 kilowatt radio station at 1510 on the AM dial, covering much of central Arizona.

Some talk radio jocks have it easy. They gab for two minutes and then play five minutes of commercials and traffic reports. (Seems like it, anyway.) Not Len. When he opens his mike at 2 p.m. each Sunday, it stays open for the full hour. Sure, there are a few commercials (very few), but they are personally voiced by Len, live.

Len knows that most of his listeners aren't hams—yet. So he doesn't spend his hour wailing about insider topics like spectrum preservation and packet business message citations. Instead, he seeks out guests who can excite his listeners by telling about the many fascinating aspects of life as a ham.

I had the privilege of being on Len's show recently. It was easy to talk with him about competitive radio direction finding because he had already been T-hunting with John Moore NJ7E. John joined us on the air to offer a challenge from Arizona RDFers to the T-hunters of Southern California.

John wanted to see how my Southern California friends and I would fare on an Arizona-style hunt during the October ARRL convention in Scottsdale. The two areas have very different philosophies about T-hunting.

So-Cal hunters love long drives and they don't mind very weak signals. Almost everyone uses a rotatable beam or quad, and many have GaAsFET preamp SSB detectors to make the most of fractional microwatt signals that could be very far away or very well concealed. The T is often 200 miles or more from the start point on day-long or all-weekend hunts.

On the other hand, Arizona hunters value speed and strategy. Though all kinds of RDF gear are seen, Doppler sets with four or eight whip antennas are most common. Fox signals are strong and distances are moderate. Hunters try to drive to the fox as quickly as possible so the post-hunt social activities can begin.

It looks like some interesting interstate competition could be coming up. Stay tuned for more.

First So-Cal R-Hunt

Suppose your club wants to try foxhunting, but only one member has any direction finding equipment. How do you put on an event to demonstrate RDF and make it possible for anyone with a mobile rig to participate? The answer: A hidden receiver hunt.

As Robin Rumbolt WA4TEM described it in *73 Amateur Radio Today* (July 1990, page 12), the fox in a hidden receiver hunt is the only one who has an RDF set. He or she listens to transmissions from the hunters and gives them bearings relative to the hidden location. Hunters add or subtract 180 degrees to or from the true fox-to-hunter bearing to get a hunter-to-fox bearing, which they plot and follow.

The Los Angeles Disaster Communications Service held an R-hunt on 27 July as a way of introducing DCS members to the fun and usefulness of RDF. The boundaries encompassed 420 square miles of central Los Angeles county.

The hunt took place on the 145.30 MHz RACES repeater. Dennis Soja KB6NJF and Dean Coulter NØCGW hid their receiver/quad RDF setup on the famous Mulholland Drive north of Hollywood. Some the bearings were inaccurate because of the intervening hills, but eventually all the competitors found them.

The first R-hunt was successful in attracting hams who had never tried RDF because they lacked the gear for it. I'm sure we'll soon see these folks on some of the 15 regular monthly Southern California T-hunts.

T-Hunters Aid FCC Bust

Just in from the city by the bay: Ham RDFers have helped the FCC nab an Advanced Class ham who allegedly had been using a modified dual-band transceiver to cross-link up to 18 law enforcement agencies. Public service dispatchers found themselves talking to units in other jurisdictions during the cross-linking. The suspect is also accused of jamming ham repeaters and cross-linking ham transmissions onto public safety frequencies.

Formal charges have not been filed as of this writing, so the assisting hams aren't talking about how they aided the FCC. All we know is that the suspect was apprehended while mobile along Highway 101 on the peninsula south of San Francisco. As this case is resolved, I hope the T-hunters will be able to share the story of their success with us.

R.I.P. PELTS

At deadline time, the FCC announced the termination of PR Docket 89-599, thus abandoning plans for a Personal Emergency Locator Transmitter System. What does this mean to hams and others interested in RDF for search and rescue? Will there soon be a crackdown on the illegal use of aircraft Emergency Locator Transmitters as personal rescue beacons? Or might this unorthodox ELT use become legalized?

RDF for wilderness safety is a topic that always generates a lot of reader interest. Look for an analysis of the current situation in an upcoming "Homing In" column. Meanwhile, I welcome your comments on the subject, or on any other RDF topic. 73

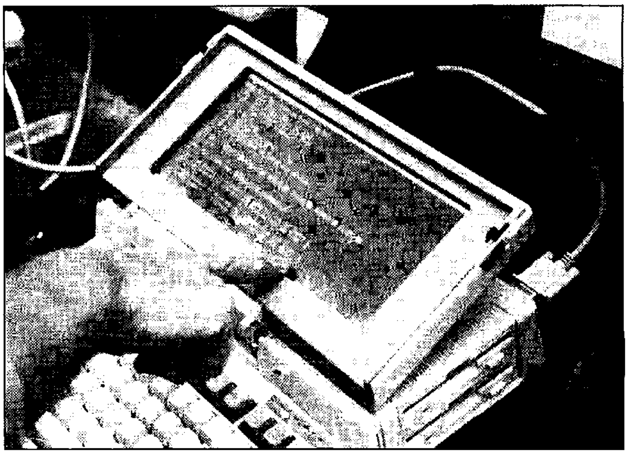

Photo A. TBOX parameters can be changed in the field with a laptop computer operating in the "dumb terminal" mode. The firmware is menu-driven.

Photo B. Len Winkler KB7LPW regaled listeners with T-hunt talk on his "Ham Radio and More" show recently.

Voice ID *Continued from page 12*

your signal is distorted, you'll have to adjust R11 to reduce the audio signal to the proper level. This is typically about 20 millivolts or so.

Repeater/Beacon/Foxhunt Voice ID

You can use the voice ID for a repeater identifier. Just hook a logic signal from a repeater controller or a timer circuit in place of switches S1 and S2. Whenever the incoming logic signal goes low, one of the messages will be played.

This would also make an excellent hidden transmitter identifier for foxhunting. Just record a tantalizing message like, "Catch me if you can!" and watch the fun and frustration as your friends try to locate the transmitter. You could even program in two messages and have them alternate. If you short out either switch S1 or S2, the voice ID circuit will play back in a continuous loop through the whole 16 seconds (if you close S1), or eight seconds (if you short out S2).

If you add the dimension of voice to a beacon transmitter, you can take advantage of the digital control power of the ISD1016 chip and sequence through multiple messages. I plan to use one in upcoming helium balloon experiments where I send up 2m FM transmitters to 100,000 feet. With a few additions to the basic voice ID circuit, the sky is definitely the limit! 73

You may contact Bill Brown c/o 73 Amateur Radio Today.

Parts List.

Semiconductors	
U2	ISD1016 (or ISD1020 or ISD1012)
U1	TLC555 timer (RS# 276-1718)
U3	7805 regulator
Q1	2N3906 PNP (or 2N4403 or 2N2907)
Q2	2N3904 NPN
D1,D2	1N914 diode (optional)
D3	1N4001 (or similar) diode
Resistors	
R13	10 ohm
R9	2.2k
R4,R12	4.7k
R1,R2,R5,R6, R10,R11,R14	10k
R7	180k (or 220k)
R8	470k
R3	1 megohm
R11,R12	10k pot. (RS# 271-282)
Capacitors	
C1,C3,C4,C6,C7	0.1 µF
C2,C11,C12	10µF/16V tantalum
C10	1.0 µF non-polarized (RS# 272-996)
C14	1.0 µF/35V tantalum
C5	4.7µF tantalum
C8,C13	22µF/16V tantalum
C9	0.22 µF
Miscellaneous	
Mike	Electret Microphone (PC-mount) (RS# 270-090)
S1,S2	Momentary-contact push-button (RS# 275-1571)
S3	DPDT toggle switch (RS# 275-626)
S4,S5	SPST toggle switch (RS# 275-624)

PC board (see below); Speaker—2" speaker;
Box—Radio Shack project box; battery; battery clip or holder

An etched and drilled printed circuit board is available for $4.60 + $1.50 per order from FAR Circuits, 18N640 Field Court, Dundee IL 60118.

The ISD 1016 audio storage IC is available for $55 + $3 shipping directly from ISD, 2841 Junction Ave., Suite 204., San Jose CA 95134. For more information, call (408) 428-1400 or (800) 825-4473.

A complete kit of parts including the PC board and the ISD 1016 is available for $99 from ELKTRONICS, 12536 TR77, Findlay OH 45840. Tel. (419) 422-8206.

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MC-6A	8	4	3	22.05
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MC-8A	6	7	4	22.05
MC-9A	8	7	4	24.15

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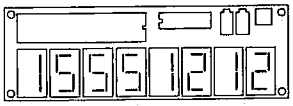

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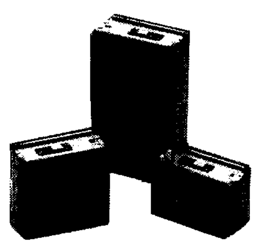

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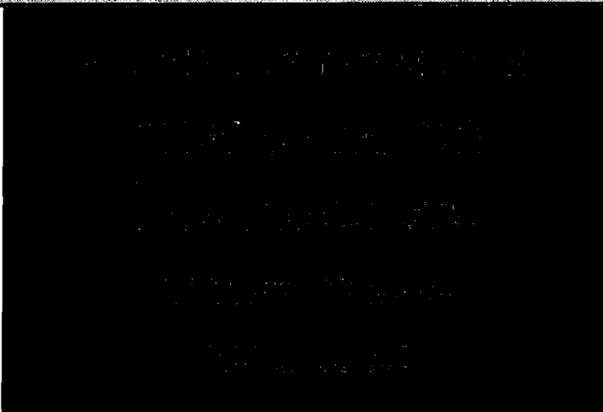

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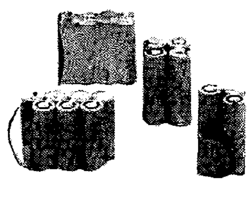

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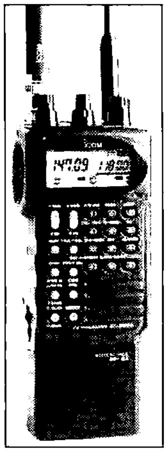
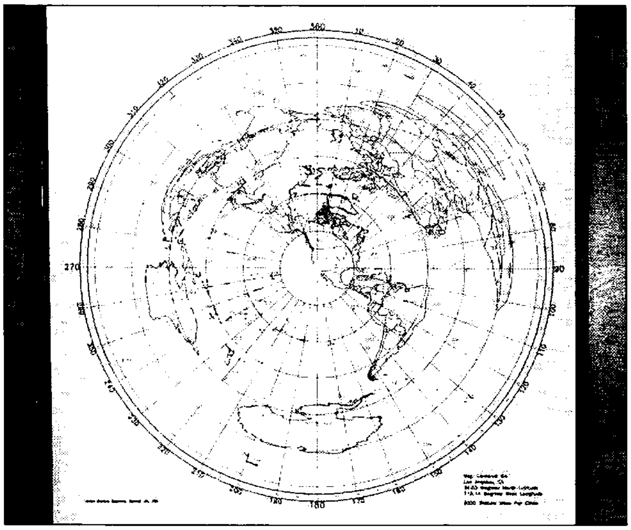


ICOM

Icom has introduced the IC-2SRA 144 MHz and IC-4SRA 440 MHz hand-held transceivers, with a wideband receiver installed directly into the unit. These compact HTs (13.6 ounces; 2.1" x 5.3" x 1.4") will receive everything from 25 to 905 MHz. If you connect an external 13.5 volt power supply, these handhelds will provide a full 5 watts of output power. Independent squelch and volume controls allow you to change settings in each band separately. Icom's frequency monitoring system lets you monitor memory channels, the complete frequency band, specific parts of the band and priority channels. There is a built-in pager and code squelch unit. The IC-2SRA and 4SRA also have 96 memory channels, a 24-hour clock, four DTMF memory channels, and a variety of tuning steps.

The suggested retail price for each model is $599. For more information, contact *Icom America, Inc., 2380 116th Ave. N.E., Bellevue WA 98004; (206) 454-8155, FAX: (206) 454-1509.* Or circle Reader Service Number 201.



VECTOR CONTROL SYSTEMS

Vector Control Systems has released a new 16" x 16" x 1" electronic beam indicator. Using a four-color custom-plotted great circle map (centered on your QTH), the indicator shows your antenna's direction and coverage with a 5 degree resolution. A simple connection to any standard rotator control unit makes the beam indicator operational. The adjustable beam width indication is a special feature which allows you to match it to your beam's radiation pattern.

The indicator is available in a glass-covered black or silver frame. It's priced at $179.95, plus $8 S & H. Contact *Vector Control Systems, 1655 North Mountain Ave., Suite 104-45, Upland CA 91786; (714) 985-6250.* Or circle Reader Service No. 204.

WINTER DESIGN

Winter Design is offering a unique gift for the office or home for engineers, technicians, hams or computer fans: a clock made from an actual etched printed circuit board. This battery-operated clock is 17" x 17", and comes in two color combinations: blue board/silver etch/silver frame/white silk screen hands and numbers; or green board/silver etch/silver frame/white silk screen hands and numbers. The price is $49.95, plus $5 S & H. Contact *Winter Design, 267 Court Rd., Winthrop MA 02152; (617) 846-5745.* Or circle Reader Service no. 207.

TRIPP LITE

The new Tripp Lite PR-Series DC power supplies are housed in a compact, dark metal cabinet that blends in with modern communications and amateur radio equipment, giving an integrated, professional appearance to any radio or electronics installation. The PR-Series gives exceptional performance for base or mobile radios, test equipment and other electronic gear. Its continuous-duty performance stands up to extended periods of operation for reliable operation under all circumstances. These DC power supplies offer crowbar protection, excellent IC voltage regulation, automatic overcurrent protection and full-line isolation, providing clean, stable DC power for your equipment.

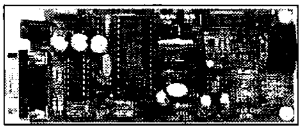
The PR-Series DC power supplies are available in 3 to 60 amp sizes, with suggested retail prices starting at $32. For more information, contact *Tripp Lite, 500 N. Orleans, Chicago IL 60610-4188; (312) 329-1777, FAX: (312) 644-6505.* Or circle Reader Service No. 203.

CONNECT SYSTEMS

Connect Systems is now offering a new low cost full duplex interconnect, the Model CS-800, which can be user-programmed to operate either full or half duplex. The Model CS-800 features a built-in repeater maker, a nine-number memory speed dialer, last number redial, a built-in user programming keyboard and digital display readout, user-programmable Morse ID, hookflash, ringout (sounds like a phone ringing), line-in-use detect/call waiting, regenerated tone or pulse dialout, programmable toll restrict, programmable connect/disconnect and secret toll override codes, programmable activity/timeout timers, non-volatile memory, and lightning protection.

The suggested retail price for Model CS-800 is $349. Contact *Connect Systems Inc., 2064 Eastman Ave., Suite 113, Ventura CA 93003; (805) 642-7184, FAX: (805) 642-7271.*. Or circle Reader Service No. 202.

A & A ENGINEERING



BayCom from A & A Engineering is a software-based packet system for PC/clones that does not require an expensive TNC. The modem plugs directly into a standard 9-pin serial port, or a 25-pin port with an optional cable adapter. A 45-second watchdog timer and reed relay PTT are standard. A small wall-power supply and a software disk are included with each kit or assembly.

No alignment is required for either HF or VHF operation. A single three-position mode switch allows HF, VHF normal or VHF with equalizer operation. The modem circuit provides improved HF receive operation.

The price for a blank board, #190-PCB, is $12.95; a complete kit, #190-KIT, is $59.95; an assembled and tested board, #190-ASY, is $89.95. U.S. Shipping is $5. California residents add 7.75% sales tax. Contact *A & A Engineering, 2521 W. LaPalma #K, Anaheim CA 92801; (714) 952-2114, FAX: (714) 952-3280.* Or circle Reader Service No. 205.

CW ENTHUSIASTS

CW Enthusiasts has released PC Super Keyer 2.1. This software for IBM compatibles provides all of the features of expensive memory and keypad keyers in an economical and easy-to-use package. It features paddle or keyboard input, disk storage space for eight unlimited-length messages, transmission of any text file, beacon operation, message within message, on-screen display of paddle input and local/UTC clocks. In addition to functioning as a keyer, PC Super Keyer will send random five-letter code groups of random or U.S. callsigns for code receive practice. The on-screen translation and display of paddle input can also be used to practice sending with a paddle.

The PC Super Keyer is priced at $24.95 for software and complete documentation, $39.95 with an interface parts kit, and $49.95 with the assembled and tested interface, plus $3 S & H. It is available on 5.25" and 3.5" disks. Contact *CW Enthusiasts, 1346 Erickson, Suite R, Columbus OH 43227-2061.* Or circle Reader Service No. 206.

RTTY LOOP

Amateur Radio Teletype

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Baltimore MD 21208

Holiday Gifts

The holidays they are a'coming! Next month begins with Chanukah, then Christmas and Kwansa. Whatever your orientation, it seems appropriate to look into gift giving this month. Let me take this opportunity to highlight items of interest to digitally-inclined amateurs.

No doubt about it, gift giving can get expensive. With amateur radio, it can get *very* expensive! But not all of us are independently wealthy, and often the pleasure inherent in a gift has nothing to do with its cost. To that end, I shall try to break down my suggestions into categories, by cost. To use this column effectively, either circle or highlight items of interest to you, or place a sticky note with an arrow on the page, leaving the magazine open on the kitchen table. A flashing red light or rotating beacon might be a bit too much, though.

Very Low Cost or Essentially Free

A piece of newsprint in a frame graces one wall of my shack. Crayoned thereon is my toddler's impression of daddy on the radio. Cost? Nil. Meaning? Unmeasurable!

Is someone in the family handy with needle and thread? How about a dust cover for the equipment, as opposed to the commercial plastic jobs? A cushion for the operating chair might be nice as well.

You get the idea? Handcrafts of any sort can be applied to the ham/computer shack in an endless variety of forms. From a ceramic holder for this or that, to a custom-made hat (bought cheaply at the variety store and hand-decorated), it doesn't have to cost a lot to be meaningful.

Under Ten Bucks

For the RTTYer who is using a mechanical teleprinter, a trip to the office supply store will turn up many useful items, which are quite affordable on a harmonic's budget. Standard Underwood typewriter ribbons fit Model 15/19 teleprinters. Various types of cleaning putty and paper products are also available to keep the print sharp and readable. A tube of Lithium grease from the hardware store can also help with machine maintenance.

Other items useful in the ham shack include a supply of solder, test clips, connectors, or other small items of use to home-brewers. Is there a local amateur supply store in your area? See if they will provide a gift certificate, to allow the ham to select his or her own goodies.

Computer-oriented hams seem to always be able to use floppy disks (be sure to get the right size) and paper for the printer. There are a variety of novelty items, ranging from special pens with which to label disks, to boxes to put those disks in, all quite nominal in price.

Software is always in fashion, as well. For the best value for the dollar, it is hard to beat the collection offered by this column. PC compatible users can obtain the latest TRTY (teletype) program, on disk, for a self-addressed stamped disk mailer and $2.00. I have been known to fill space on high density (1.2 and 1.44 Mb) disks with extra programs, as well. Send requests to the above address.

Commercial sources include Aero Data Systems, a *73* advertiser who offers a wide variety of programs for PC clones, Amiga, and C-64 systems. Priced at $4.50 per disk, this is a good way to obtain some fine public domain and shareware offerings.

Reasonably Priced

I know, what's "reasonable"? My intent here is to look at stuff which is under a hundred dollars, and which represents good value for the dollar. So, while price is not the only objective, I will use it as a yardstick.

How about a good book? Our dear old Uncle Wayne has a Bookshelf just loaded with sources you will want. Here's a partial list.

- 07R25, *The RTTY Listener*: Up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. $19.95
- 03S208, *Radioteletype Press Broadcasts*: Press service schedules in English, French, German, Spanish and Portuguese. $12.95
- 03R01, *World Press Services Frequencies (RTTY)*: 5th edition manual with all information, plus coverage of 65 World Press Services broadcasting In English. $8.95
- 03R02, *RTTY Today*: Covers all facets of RTTY, fully illustrated. $8.50
- 01P22, *The Packet Radio Handbook*: The definitive guide to amateur packet operation. $14.50

Users of the AEA line of multimode controllers often express a desire for more powerful controller software. PktGOLD is advertised as one such program. It should greatly expand the capabilities of the PK-232 and PK-88 controllers. The program is available for $59.95 plus $5 shipping and handling from InterFlex Systems Design Corporation.

Do you have a CD-ROM drive on your computer? Buckmaster Publishing has the HamCall CD-ROM, which has listings on 500,000 amateurs, plus "1000's of public domain amateur radio programs and data." The disk itself is only $50, cheaper than a stack of *Callbooks*! Contact Buckmaster for full details.

More Than A C Note

Now, there will be situations and circumstances where someone might be willing to spend some real money on you. Other than the obvious items, a new computer, printer, or radio gear, let's take a look at some specific material of particular use to the RTTYer.

In most RTTY shacks, there is never enough test equipment. Frequency counters seem invaluable for a mode so locked into certain frequencies. Startek International has a 1500 MHz hand-held counter with accessories for $128, which should find a place on any amateur's bench.

We've covered WEFAX here before, so take a look at Software Systems Consulting's PC GOES/WEFAX 3.0, for $250. This is a professional FAX reception system for PC clones. Including an AM/FM demodulator, software, and tutorial, this looks like one capable system. For a bit less money, their PC HF Facsimile 5.0 is an HF FAX system, also including an FSK demodulator. This one is available for S99. They tell me that if you get PC HF FAX, you can add PC SWL for another $20. This is a demodulator, software, and manuals to get you onto listening to Morse, RTTY, and other modes on the HF spectrum. Overall, these sound like very interesting packages.

MFJ is now offering their MFJ-1278, a multimode controller that features packet, AMTOR, RTTY, ASCII, CW, FAX, SSTV, and more, with color SSTV supported with appropriate software. At $279.95 for the base unit, this one will be hard to beat! I wouldn't mind getting one of these, myself!

AEA has updated the venerable PK-232MBX with new software, reportedly making it a strong contender on the air. Their new DSP-2232 looks very good on paper, and I look forward to reviewing it as soon as information becomes available.

So, What'cha Gonna Do?

I hope I have been able to plant a seed or two that might germinate into something wonderful this holiday season. As we gather together to observe our various customs, let us reflect upon the wonder of amateur radio. This hobby of ours is unique in that it breaks down boundaries, bridges languages, and allows cultures to communicate. Through communication comes understanding. Through understanding comes friendship. Through friendship comes peace. May this be a season of peace and understanding for all of us, our families, friends, neighbors, and governments.

I look forward to hearing from you by mail, or by e-mail on CompuServe (ppn 75036,2501) or Delphi (username MARCWA3AJR). As I write this, I am looking at another on-line service as well. Perhaps I'll write more on that one down the road, along with other goodies here on RTTY Loop. 73

Companies Mentioned in this Column

Advanced Electronic Applications, Inc. (AEA)
P.O. Box C2160/2006 196th St. S.W
Lynnwood WA 98036
(206) 775-7373

Aero Data Systems
P.O. Box 9325
Livonia MI 48151
(313) 471-1787

Buckmaster Publishing
Rt. 3, Box 56
Mineral VA 23117
(703) 894-5777

InterFlex Systems Design Corporation
P.O. Box 6418
Laguna Niguel CA 92607-6418
(714) 496-6639

MFJ Enterprises, Inc.
Box 494
Mississippi State MS 39762
(601) 323-6551

Software Systems Consulling
615 S. El Camino Real
San Clemente CA 92672
(714) 498-5784

Startek International Inc.
398 NE 38th Street
Ft. Lauderdale FL 33334
(305) 561-2211

Uncle Wayne's Bookshelf
73 Amateur Radio Today
P.O. Box 3080
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Microwave PLL Brick Filters

The basic filter covered last month was the most inexpensive filter available—a tin can and a variable capacitor. This month I'll continue to cover filters and their applications as they pertain to microwave oscillator (brick) filters, in particular the modification for operation on the amateur band. This modification requires re-tuning the filter about 1 GHz lower in frequency.

The moditication of the phase-locked oscillator's filter can involve a little bit of black magic, which I hope to unmask. It's easy to modify brick filters if you have a spectrum analyzer handy, but you can also adjust them to the desired frequency with a power meter. However, you can never be quite sure that it is providing proper harmonic output when completed.

Power and Crystal Oscillators

Surplus brick oscillators were originally constructed for the commercial common carrier frequency bands 5.9–6.8 GHz and 10.7–12.7 GHz. These frequency bricks are of prime interest to amateurs for both the 6 and 10 GHz bands. The bandwidth of the original filler varies from 300 to 500 MHz at the 3 dB points. Whatever frequency brick you select, it must be electrically and mechanically sound.

The brick oscillator has a high power oscillator operating in the 1.2–2 GHz range with about 1/4 watt power output. This oscillator is compared to a crystal in the 90 to 108 MHz range and is phase-locked by a varactor control circuit to lock the high power oscillator to a harmonic of the crystal oscillator. This harmonic number is normally the 12th in a 6 GHz brick, and uses the 17th or 18th harmonic in a 10 GHz brick.

This power oscillator is adjustable with a cavity tuning screw to obtain phase-lock in reference to the crystal oscillator. The output from the power oscillator is then coupled to a step-recovery diode frequency multiplier, and the selected harmonic is passed by the output microwave filter. This is all part of the multiplier assembly, which is the top rectangular module under the blue label, as shown in Photo A.

The filter's job on this assembly is to attenuate all unwanted harmonics. The output of the SRD multiplier is rich in harmonics. The filter can be hundreds of MHz wide and still be effective. In a 10 GHz brick, it can reject the 16th and 18th harmonic and pass the 17th harmonic. Most bricks that you find will cover a wide variation in frequency, but electrically they are the same. The big difference is where the filter is tuned, and for very high frequency operation some cavity dimensions are shorter. This makes modifying a 12.5 GHz brick a little harder than an 11.5 GHz brick.

Let's get into the modification details. I will modify a Frequency West brick. Though the principles of modification are also applicable to the California Microwave bricks, they require slightly different construction methods. Two different types of filters are used, and I will cover them both.

The Frequency West Brick

The 10 GHz Frequency West brick I converted was originally set for operation between 10.750 GHz–11.750 GHz. I re-tuned it to 10223 MHz in the 10 GHz amateur band. In a 6 GHz brick the filter is re-tuned to 5.615 GHz, assuming you are using a 145 MHz multimode radio for the variable IF. This produces 10.368 GHz and 5.760 GHz, which is the upper mix products using a 2 meter transceiver for our IF.

The Frequency West PLL brick high power oscillator is pre-set to the low end of the filter passband, as evidenced by reduced output power. Adjust the filter slightly to increase power, repeating this procedure several times until the filter frequency is within the target frequency of 10.223 GHz.

In difficult cases, with the filter mistuned and no output signal, you have a problem. Real black magic is now at hand. Go slow and do not tune the filter in large steps. Remember which element (last adjusted) caused trouble, and return it to its prior setting before adjusting another element of the filter. When out of wack, it's quite hard to set up without good test equipment.

The brick will give a swept output when operating without a crystal. It is being swept by an internal housekeeping circuit used to obtain phase-lock whenever power is turned off and on. This sweep circuit is disabled automatically when the low frequency crystal is functioning.

Modification Details

Begin the modification by removing the blue label on top of the unit, pealing it back slowly. This reveals four large screws recessed on the corners of the unit. Unscrewing the panel allows you to remove the multiplier assembly (required on some units). However, if your unit has a set of five Allen set screws held in place with lock nuts, you do not need to remove the multiplier to make the adjustments. But if your unit has only the Allen screws, you *will* need to remove the multiplier.

To unmount the multiplier, remove the four 6/32 bolts, lift the module up, and swing it around 180 degrees. After you complete the modification of the oscillator, reinstall the multiplier by reversing these directions. Then place the coupling probe back into the cavity port and hold it in place with a mounting screw, clamp, or several rubber bands.

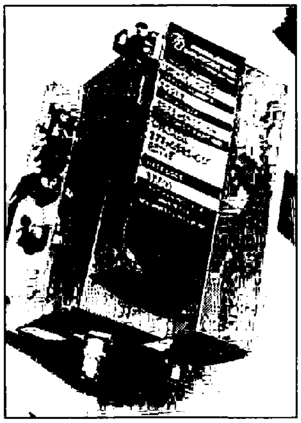

Photo A. The Frequency West 6 GHz PLL brick. It's mechanically similar to the 10 GHz brick. Remove the blue label on top to access the filter adjust screws.

When the unit is in this position you have access to the real tuning screws. (Note: Some units have an access plate on the back portion of the module which you must remove to give clearance to the inside Allen filter screws). The screws on top are lock screws (Allen head 0.035 inch), and the Allen screws on the inside of the multiplier assembly, just under the lock screws, are the filler adjusting screws.

Movement of the filter screws is not radical, and filter alignment will be facilitated with less than one turn of the set screw. Go slow. Unlock the locking screws first, and only then, when you are ready to observe power or output on a spectrum analyzer, make filler adjustments. I have not worried about passband results, just peak power output at the frequency of interest.

Once the proper frequency is reached, you can insert the crystal into the circuit and attempt phase-lock. The crystal is adjusted by turning a small variable capacitor while watching the "XTAL" lead on the side of the brick for DC voltage output. A voltage of about 0.5 VDC indicates that the crystal is oscillating. Adjust the cavity tuning screw while watching the "0" or phase-lock terminal. Normally, out-of-lock is a steady negative 10–13 volts. This voltage will jump to a value of between 2–13 volts. When in-lock, this voltage will follow small adjustments of the cavity tuning screw.

When phase-lock is obtained, you should be near the exact microwave frequency desired. Slight adjustment of the low frequency oscillator circuit will obtain the desired results. This, of course, depends on the crystal being set to exactly the proper frequency. For example, in my brick I wanted a final frequency of 10.223 GHz (10223 MHz). This required a crystal of 100.2254902 MHz, the 102th harmonic of which is exactly 10.223 GHz. Close enough for government work.

Now, with phase-lock and proper frequency output, you can do a final adjustment on the filter for peak output, then lock the adjustments down. I usually obtain +7 to +10 dBm power output, plenty of power for a mixer at 10 GHz. Final adjustments take time, as you might have to jiggle both the filter

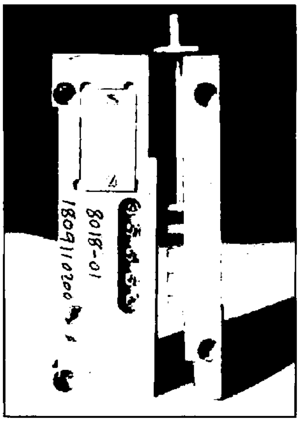

Photo B. The 10 GHz filter assembly. Note the 5-pole filter elements. The last element is connected to coax with an SMA output connector. When the filter is assembled, the five elements are next to and under the lock nuts of the five screws on top of the filter body. The filter elements are inside the filter body. Screws and lock nuts are under the blue factory label, and the four mounting holes are on the filter's edges.

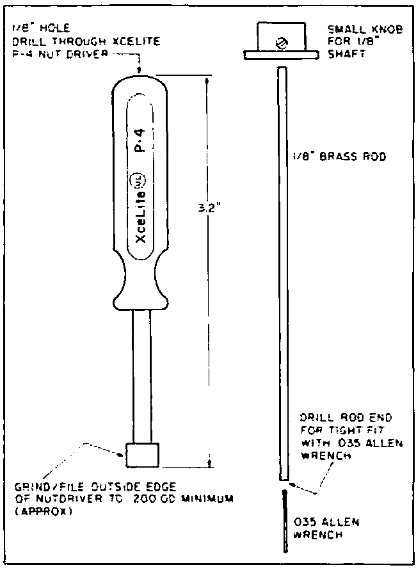

Figure. You can modify a nut driver to construct a tool for brick filter alignment.

and lock screws. There is some displacement of the adjustment screw when the lock screw is tightened, and both screws must be done together or all is for naught. Balance the lock screw's action with the adjust screw; it's a matter of feel, and you will see what I mean when you try it.

Adjustment Tool

It's difficult to adjust the screw and lock nut with an Allen wrench and a pair of pliers. To overcome this problem, I constructed a two-stage tool by modifying a standard nut driver that fits the lock nut. See the figure for details. The nut driver is modified by first drilling a hole about 1/8-inch in diameter through the length of the plastic handle so a solid brass rod can be inserted through the nut driver, handle and all. I used an Xcelite™ P-4 nut driver (0.129-inch hex head nut driver).

In turn, the brass rod is drilled on one end to accept the 0.035-inch Allen wrench. Brass is soft; under-drill the hole slightly, at about 0.032 inches, so the Allen wrench will fit tightly. The hole will expand slightly to accommodate it. On the other end, attach a small knob to the shaft. Use the nut driver to unlock the lock nut, and the Allen screw to adjust the filter element. While holding alignment steady, the lock nut is turned tighter. You will have to do this several times to obtain maximum output on each filter element.

The procedure is the same for those bricks with top locking screws and a side filter. In this model, you may have to use two Allen wrenches. On both filter assemblies there is a small potentiometer that should be left alone unless you have high output on 11 as well as 10 GHz. This is the bias adjust for the SRD multiplier diode. It's best adjusted while watching the oscillator on a spectrum analyzer for minimum high harmonic output.

And that's it. If you removed the multiplier assembly, reassemble it by rotating it 180 degrees and replacing the four screws that you originally removed. The probe into the RF compartment is self-centering.

A small rubber boot can be made to cover the crystal, forming an insulator for the oven assembly. You can construct one out of about an inch and a half of monkey rubber tape, which is available at most hardware stores. When stretched slightly, the tape will adhere to itself. I wrap it around the crystal heater and fold the excess on top of the crystal, making a little box affair to shield the crystal from draft and maintain temperature stability.

Brick Availability

These surplus brick oscillators are being removed from commercial telephone service. As more and more older systems are being replaced with digital and light guide facilities, surplus channels will acquire more and more of these oscillators and other high quality microwave components useful to the amateur microwave technician.

I have picked up a small quantity of the 10 GHz phase-locked brick oscillators, and will make them available for $50 postpaid in the U.S. If you want me to re-tune the output filter to 10.223 GHz, I will be glad to do so for an additional $15. It takes about a half hour to completely tune one up.

By the way, the crystal used in these oscillators is available from International Crystal Co. and costs about $20. Specify Frequency West part #585132 and the type of brick you have, such as Frequency West 54XOL output frequency 10.223 GHz.

Other articles in *73* have covered these brick oscillators. Check out June and July 1990 for temperature control and typical internal crystal oscillators. Full details with block diagrams covering a 5 GHz brick were in the September 1990 "Above & Beyond" column. For the 10 GHz brick system, see this column in the December 1989 issue.

That's it for this month. I'm getting ready for the 10 GHz ARRL contest and will update you on operations and any unusual happenings. As always I will answer questions concerning microwave and related topics. Please enclose an SASE for prompt reply.

73 Chuck WB6IGP

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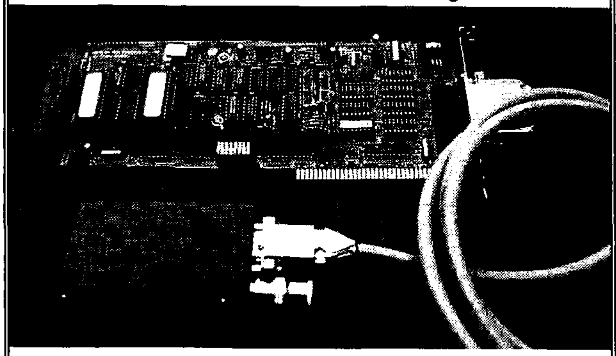

The PackeTwin data radio system, with integrated 9600 bps radio modem (G3RUH/K9NG compatible) and a 440 Mhz radio (*antenna* not included).

The PackeTwin is a high performance, dual-channel, sync/async PC interface card for data radio systems, with TCP/IP and AX.25 software (executable and driver sources provided.) Speeds of 1200 to 1 Mb/sec operation utilizing full duplex DMA. RS-422, RS-232, and TTL. The PackeTwin data radio is a single channel, half-duplex, crystal controlled unit delivering 2 watts output available in the 430-450 Mhz and 450-470 Mhz frequency ranges.

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We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS /Hamhelp SIG. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525–4438). Use upper- and lowercase letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Can anyone help a DXer to get some old-fashioned transmitter and modern-day shortwave sets? A Yaesu FRG-8800, any HW101 homebrew 21 MHz CW transmitter, and a 21 MHz shortwave, would do good for DXing. Thanks. *Mac Arthur Herman Moore KA3LLY, 5230 Heston St., Philadelphia PA 19131.*

Wanted: Schematic and/or manual for Eico Model 315 Signal Generator. Will pay copy and mailing costs. *Larry Keith KF8BX, 4251 Meadowsweet Dr., Dayton OH 45424. Telephone: (513) 233–1148.*

I need a schematic for a Regency HR2-A 2m FM radio for a new ham in my radio club. Please send reply to *Steve Lempke WA1MZL, 1538 N. Main St., Fall River MA 02720* or call *(508) 675–9923* after 5:30 PM EDT. Thanks.

Donations needed for an expedition: 6 meter SSB-CW rig, 100 W S.S. Amp & Beam, 2 m SSB-CW rig, 150 W output amp., 1 superlong yagi. Purpose is to give out new countries on 2 meter EME. Please send packages (marked "GIFT") to *PS7KM, Karl Mesquita Leite, Box 385, 59000, Natal, RN.* Thanks, from John WB8IGY of Cincinnati OH.

Wanted: Schematic and Manual for the Motorola U43HHT Low Band Rig, Receiver and Transmitter. Please mail to *9Y4VU, Franklin Brooker, 43 Seaview Dr., Battoo Lands, Mirabella, Trinidad.*

Wanted: August 1984 QST magazine or copy of the article entitled "Some Basics of VHF Design and Layout." Also, service manuals for Uniden HR-2600 and Heath HWS-2 HT. *Glenn KB5AYO, RT. 1 Box 580-B, Reserve LA 70084.*

Varian G-10 Chart Recorder. Need schematic and/or manual. I intend to solid-state it. Will pay copying and postage. *Brian WA5PPO, 6848 E. 45 St., Tucson AZ 85730-2214.*

Number 20 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Satellite Operation Today

A decade ago, few would have believed the day would come when there would be so many operational amateur radio satellites that one could be above a station's horizon almost continuously. Today we have 13. If you count the Russian space station *Mir*, with its 145.55 MHz packet BBS, we have 14. With multiple transponders on most of the spacecraft, satellite chasers have many options ranging from HF to microwave activity.

Although some might consider the HF transponders on RS-12 and RS-13 for relatively short-range contacts, others have found them to be a medium for worldwide communication. Using the Mode K transponder on RS-12 (uplink 21.210–21.250 MHz, downlink 29.410–29.450 MHz), over-the-horizon DX is possible when skip conditions permit it. A complete frequency chart for RS-12/13 is in the May 1991 "Hamsats."

For the UHF and microwave enthusiast, the Mode S transponder on AMSAT-OSCAR-13 (uplink 435.603–435.639 MHz, downlink 2400.711–2400.664 MHz) has provided many opportunities to work with 2.4 GHz equipment and make worldwide contacts via satellite.

Most satellite chasers prefer Mode A (2 meters up and 10 meters down) via RS-10/11 or Mode B (70cm up and 2 meters down) via A-O-13 or A-O-10. While RS-10/11 is in a low-earth orbit (several hundred miles high), A-O-13 and A-O-10 are in highly-elliptical orbits, traveling out past 20,000 miles at apogee, the orbit's farthest point from the earth. Even though the elliptical orbit satellites have gain antennas and high power transponders, ground stations will need quality antennas and expensive equipment for easy contacts. The RS-10/11 station is usually less complex, but the satellite's coverage is also less, due to the lower orbit.

Since the launch earlier this year of RS-14, also known as RADIO-M1, RUDAK-2 or AMSAT-OSCAR-21, hams have had a Mode B transponder in low-earth orbit requiring only omni antennas like ground planes for consistent contacts via satellite. The May 1991 "Hamsats" also had a frequency chart for this hamsat.

Simple Earth Stations

Getting active via satellite can be easy. To work RS-10 Mode A, all that is required is a good 10 meter receiver with a dipole and a 2 meter transmitter capable of CW or SSB with an omni-directional antenna.

Some FM rigs are capable of CW uplink by keying the microphone push-to-talk switch, but many will exhibit excessive chirp with this method. It's worth a try. An alternative is a used, multimode 2 meter rig. One can usually be found for a few hundred dollars at a swapfest. Inexpensive older rigs to look for include the Kenwood TS-700A, the Yaesu FT-480R and the ICOM IC-251. A simple quarter-wave ground plane antenna for 2 meters can be purchased or made from coat hangers and a SO-239 connector. The Lakeview Co. model GP-10-2 by WD4BUM is a very nice ground plane that can be quickly assembled for easy portable operation. Another good choice would be the MAX System ground plane antenna from Cellular Security Group.

On a recent trip out west, I used a Lakeview antenna for many successful contacts via RS-10. My uplink power was about 10 watts through 20 feet of RG-8 coax. For the downlink, I stretched a dipole made from hook-up wire between two trees. The feedline was a short run of RG-58 to a Uniden HR-2510. Although a small MOSFET preamplifier was available, it was not necessary for most contacts. A 12 volt power supply powered the radios, but a battery would have done the job as well.

Operation via the Mode B linear transponder on A-O-21 proved to be just as easy as A on RS-10. Ten watts to the 440 MHz version of the Lakeview ground plane proved sufficient for quality contacts whenever the satellite was above the horizon. A GaAsFET preamplifier was employed for the 2 meter downlink. It wasn't necessary, but it helped during times when the satellite was low in the sky.

Although I didn't try it during the western trip, mobile operation should do very well on A-O-21. A single quarter-wave whip for 2 meters could be used for both 70cm uplink and 2 meter downlink. A diplexer would be needed, but they have become very common in recent years due to the popularity of dual-band mobile operation through FM repeaters. For those interested in building their own, the September 1989 issue of *Ham Radio* presented a very simple, easy-to-build diplexer in the "Ham Notebook" column.

Photo A. WA5ZIB and WA5WOD with portable station in central Texas.

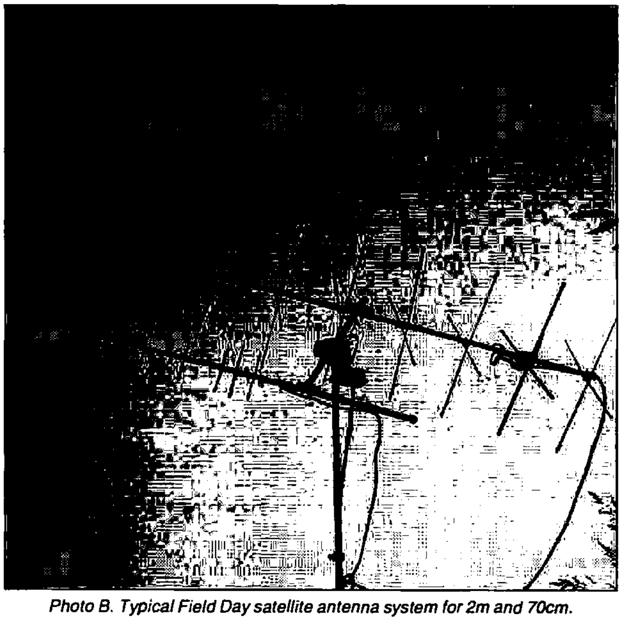

Photo B. Typical Field Day satellite antenna system for 2m and 70cm.

The success of A-O-21 activity with nothing more than ground plane antennas was inspiring. AMSAT-OSCAR-13 was oriented to provide excellent signals after apogee (when the satellite is closer) rather than during. I had been able to hear conversations in the passband with the ground plane and preamp, so I tried the 70cm uplink. Signals were so weak I could barely hear my own CW, but it was there. After several attempts at contacts, a very patient WD6EPV came back with an answer to my call. Ten watts to a ground plane is not much for contact via a satellite 15,000 miles away, but it will work under optimum conditions, and if the operator on the other end has a good system and an excellent ear.

Other Simple Systems

It's not necessary to see how small an antenna system can be and still work for satellite activity. A few hams have put their stations in backpacks and used shoulder-mounted beams to make contacts via the high-orbit hamsats. Others have had simple, yet effective, stations on boats, and several have tried mobile satellite work. Field Day is another opportunity for innovative installations.

The idea is to use available equipment to make contacts via satellite, and add system improvements for more serious efforts as time and money allow. An omnidirectional antenna on 2 meters can be the beginning of a home satellite system with the inclusion of almost any 10 meter rig and antenna. For that matter, the simple 2 meter home antenna could be immediately put to good use making contacts with U5MIR-1, the packet BBS on *Mir* (145.55 MHz FM simplex). Similarly, signals from DOVE-OSCAR-17 and UoSAT-OSCAR-11 can be monitored with simple systems tuned to 145.825 MHz FM.

The addition of at least one beam antenna with azimuth and elevation control marks the beginning of serious satellite activity. Expensive computer-controlled rotators are not necessary. Jack KA5DNP, author of "The Field Day Special—the 'Ray Gun' " in the June 1990 issue of *73*, doesn't use rotators at all, and has DXCC via satellite. Older TV rotators provides excellent service if you need remote control or who wish to pursue fast-moving, low-orbit birds. 73

ASK KABOOM

The Tech Answer Man

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Everything To Gain

Before we get to this month's topic, let me direct you to the table on page 73 listing those parts source addresses I promised last month. By no means does this list include all of the mail-order outfits out there, but it should give you a starting point. By the way, these names all come from catalogs I have here in my home lab. You, too, can get these catalogs, and most of them are free. I strongly recommend that you get as many as you can.

Now for our next topic: GAIN. What is it, and why is it so important? The foundation of modern electronic technology, including radio, television, the digital computer, and virtually anything else you can think of, is the ability to make a small signal bigger! Without that crucial function, we'd be back to crystal sets and earphones. We call this function "gain," and the devices which perform it "amplifiers."

I'll go out on a limb here by stating that the first device capable of signal gain was the triode tube, invented by Lee DeForest. I think there may have been some earlier, experimental magnetic devices, but the tube was the first to be widely employed. It ushered in the radio age and all that was to follow.

The Signal Itself

Before we can examine the phenomenon of gain, we have to take a look at what we're trying to make bigger in the first place: the signal. What is a signal? A signal is simply a changing voltage or current whose changes represent some kind of intelligence. It is easiest to think of it in terms of voltage.

Imagine a graph where the "X" (horizontal) axis represents time. The "Y" (vertical) axis represents the voltage. As the voltage changes over time, it draws a graph of the signal. That signal may be a sine wave, a pulse, or perhaps many waves whose overall level, or envelope, changes over the course of several cycles.

In any event, the signal will get smaller as it passes through the air in a radio transmission or through wires, because no path or conductor is without loss. (OK, perhaps a superconductor comes close, but we're not living in the superconductor age yet.) In radio, the strength of the signal decreases proportional to the square of the distance from the antenna. In other words, if you go twice as far away as you were, the signal is only one quarter as strong. If you go four times as far, it is only one sixteenth as strong. That occurs because the energy is spreading out to fill the surrounding area, so you are receiving smaller and smaller pieces of it. By the way, that's why satellite dish antennas for TV need to be so big: to collect enough of the satellite's extremely weak signal to be able to detect it.

Of course, radio is much more complicated than the "inverse square" law, which doesn't take into account ionospheric reflection and other phenomena. But at least you can see what we're up against. So how do we make such tiny signals useful? We amplify them, of course!

Two Ways to Make it Bigger

There are two kinds of amplification or signal gain: voltage gain and current gain. That may seem confusing, but it is easy to explain. Voltage gain is when the voltage swings of the input signal to the amplifier cause bigger ones at its output. This type of gain may cause a 0.1 volt peak-to-peak input signal to drive the amplifier to 10 volts p-p. That would be a voltage gain of 100.

Current gain is when the amplifier's output swings are the same size as its input swings, but the output can drive a much lower impedance load before getting bogged down and losing voltage. So, a signal that can deliver 2 volts p-p into 1000 ohms might be reduced to only 0.01 volts if you tried to drive an 8 ohm speaker with it. But a current amplifier can keep it at 2 volts into the 8 ohm load.

Now that we know what gain is, let's look at how it is produced.

Nothing: The Essential Factor

We all know that a tube is nothing more than some metal pieces and a filament inside an airless glass envelope. Nothing magical and theoretically complex like a semiconductor. So why does it exhibit gain?

Tubes use the natural tendency of electrons to accelerate when attracted through space to an opposite polarity. Specifically, if you boil some electrons off a hot electrode (a piece of metal) and put another electrode nearby, and then make the second one positive with respect to the first, the electrons will pick up speed on the journey and slam into the positive electrode harder than they were moving when they left. So what? Well, if you put yet another electrode (called a "grid") near the first one, you can block or let pass the moving electrons by putting a small amount of voltage (your signal) on it. It acts like a gate. In fact, the British still call tubes "valves," because that's essentially what they are.

When the traveling electrons, which are now varying with the signal, slam into the plate, they make it more negative (in other words, less positive) than it was before, and the amount they change it is proportional to how many electrons have been passed by the grid and how fast they were moving. And there you have it: gain! The output will vary with the input, only bigger.

Whew. Now you know why it took mankind umpteen thousands of years to discover this phenomenon. Also, having a vacuum pump helps, because you can't make this work at all if there is any gas (such as air) inside the tube. The electrons collide with the gas atoms and never make it to the plate.

Something Messy

Solid state devices do pretty much the same thing, only they do it not by attracting electrons through space, but by permitting them to migrate through certain kinds of materials which can conduct energy only under certain circumstances. I know that sounds vague but, believe me, the physics is messy and not worth getting into here. Essentially, it all comes down to a gate which either restricts or permits electron flow, along with the ability to magnify what flow there is. In transistors, that ability comes from the generation of "holes" of missing electrons in an atomic crystal lattice pattern, which can then be filled by other electrons traveling from another part of the transistor. See, I told you it was messy. The advantage over tubes is that no hot electrode is required, because the electrons don't have to be projected into space. Also, you don't need a vacuum.

Well, once again we're out of space, so we'll continue our discussion of gain next time. There's lots more to cover. 73 for now.

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Never Say Die

Continued from page 4

. . .and he knows me too. As does his father, the ex-governor. . .as does ex-governor Sununu and ex-governor Peterson. Bragging again? Nope, I'm explaining how you can help change things. And you won't do it by sitting there like a lump in a bog.

If we can get our schools back on track. If we can get 'em busy teaching science so our kids will be able to cope with the technology of 2000 and not have to call in the Japanese to fix their equipment, we'll have enough young hams to start contributing to the advance of communications again.

Is that a massive sigh I sense? Too much trouble, right? So okay, we're failing our kids. We're turning a blind eye to the educational mess they're in. Just as we are too busy to train our dogs to behave, we're too busy to bother bringing up our kids. Too busy doing what? "Don't bother me now."

Fathers talk with their kids 16 minutes a week. . .and that's the national average. No wonder our educational system is one of the worst in the developed world. No wonder our kids are so much more into cruising, drugs, sex, and beer than amateur radio and other scientific hobbies.

When I start hearing your 10-year-olds on your rig calling CQ, I'll know there's some hope. When I start seeing your kids at hamfests, I'll lighten up. When I start getting pictures from clubs showing bright young faces with calls, I'll find something else to fret about.

Pan Am and Airline History

A few years back I was able to get my father to write a series for *73* on his early experiences in aviation. I tried to get him to write more, since the reader reception was so positive. . .though it wasn't even remotely about amateur radio! But he only wanted to write about the positive things he'd been through and refused to tell the rest of the story.

With Pan Am's recent bankruptcy I got to remembering how much that company had affected my life. Well, how its president, Juan Trippe, had affected it. And Trippe's good buddy, FDR.

My dad got involved with flying right after WWI, learning to fly in 1921 (pilot's license #73) with the Army in San Antonio. I was born the next year and within months he was taking me up with him. I grew up around the big Martin bombers at Langley Field in Hampton, Virginia, where he flew with Jimmy Doolittle. . .the chap who tried to convince the Army that airplanes had a future and could even sink ships.

After leaving the Army he barnstormed for a while and then worked for the Department of Commerce, giving pilot tests and putting together the first guide to American airports. He had commercial pilot's license #89.

This led to his being hired to design and build Philadelphia's Central Airport. Then Jim Eaton of Luddington Airlines hired him as passenger and cargo manager, so we moved to Washington when I was nine. When Luddington sold out to Eastern Air Transport in 1933, he and Jim decided to start a New York to Boston airline. Marine Airlines would use flying boats and go directly from downtown Manhattan to downtown Boston, cutting the commuting time substantially.

The other airlines were enthusiastic about connecting to this new service, so they provided the needed investment. Except for Trippe of Pan Am. He'd been using flying boats on his South American flights and was worried about his turf. He didn 't want any other airlines using flying boats.

Pan American was our only overseas airline at the time, so Juan Trippe cultivated FDR as a friend as a way to help protect this edge. A whisper in Roosevelt's ear resulted in an Executive Order that no airline could own stock in another airline. Today, if a president were to do that, the press would be all over him and raise hell. There wasn't much accountability then, so FDR and Trippe got away with it and Marine Airlines was sunk before it ever got going.

Tough break. Two years of hard work torpedoed. But that's the way it is with entrepreneurs. . .they gamble on an idea. Sometimes it pays off and sometimes a catastrophe comes along and blooie.

Jim and Dad didn't funk for long. They thought big. OK, then how about a trans-Atlantic airline? They got together with the owners of American Export Lines, the largest American steamship line, and convinced them that air travel would eventually eclipse ship travel. This was around 1936, mind you. Pan Am had expanded into the Pacific, so it didn't take a lot of convincing to get American Export to see the writing on the wall.

My father headed for Europe to set up bases for the planes. Most of American Export's ships cruised the Mediterranean, so that's where he spent about a year setting up seaplane base agreements with the governments. I'd get postcards from Oran, Genoa, Alexandria, Beirut, and Tripoli.

I've got a bunch of pictures I took of the PBY they used for the survey flights in 1938–1940. Dad set up a seaplane base in Botwood, Newfoundland, for the summer crossings and others in Belem, Brazil, and in Dakar, Senegal, for the winter crossings. Just as they were getting going with regular passenger service we had a little war, so the Navy used the airline for their purposes.

Trippe was not happy about all this. He kept pushing Roosevelt to have America allow just one international airline. . .Pan American Airways (PAA). It was called a "chosen instrument." With Britain backing BOAC, France doing Air France, and so on, he urged FDR to choose PAA. Roosevelt agreed and shortly before he died he issued an Executive Order saying that no steamship line could own stock in an airline.

American Export, having invested millions in the project, and having had to let the Navy use it through the war, was furious. Trippe offered to buy American Export Airlines, but he didn't offer much. The American Export people said hell would freeze over before they'd sell to Trippe.

American Airlines made an offer, so it became American Overseas Airlines. . .for about a year. Then American sold it to PAA. Sneaky deal. But long before PAA took over, American had eased out the Export management by putting their own managers in over them and taking away their authority. They didn't fire them, of course.

Jim didn't take this second setback well and soon died. My father went fishing. But not for long. Aer Lingus, the national Irish airline, wanted a trans-Atlantic division, so they hired Dad to set it up.

He spent the next couple years building the new airline for Ireland. It meant setting up ticket offices, buying planes, hiring and training crews. . . the works. Then, a few weeks before the inaugural flight, there was an election in Ireland and De Valera was ousted as Prime Minister. The new chap came in promising economy, so he immediately stopped the airline. . . despite tens of millions of dollars in presold tickets.

Dad sold off the planes for them, helped the employees find other work and closed down the operation. A few years later De Valera was re-elected and Aer Lingus asked my father to build Irish Airlines again. He said no. Ireland managed to waste hundreds of millions and set themselves back years with that dumb political move.

A few years ago, when I decided to set up a software operation in Ireland, I visited Jack Kelly-Rodgers, who'd been the president of Aer Lingus and had visited us many times in Brooklyn, and we reminisced over how badly that debacle had hurt Ireland.

Even after three crushing disappointments my dad was game to have a try at building a helicopter plant for Kamman. He took a room in Suffield (CT), coming home on weekends, and organized the factory for Kamman at Bradley Field. It was the first time anyone had gotten the Navy to put up the money to build a factory.

The son of the people he lived with recently got his Novice ticket. . .small world department. And Kamman's son

QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year Subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

is in the music business making guitars.

Entrepreneurship

While being an entrepreneur doesn't always pay off. . . and never did for my father, so we never had much money. . . it's sure more exciting and fun than working for a large business. Not having money was good training for me. And with both my father and my grandfather being entrepreneurs, it was natural for me to go that route.

Sure, I've made some money, more by accident than on purpose, but that hasn't changed my frugal habits. All of my money has been invested in providing jobs for people as I spin off one new company after another. Some of the people have done well with my money, others have wasted it. . . and themselves in the process.

The huge publishing conglomerate I sold eight years ago has now almost completely disintegrated. None of the seven magazines has prospered in recent years and all but two failed. My huge software firm is gone. Even the book publishing business is gone.

I saw all this happening, but was unable to change the corporate management approach which was at the heart of the failure. The October *Analog* has a fascinating article on what went wrong with the Hubble telescope. Too bad if you missed it. The author points out that all successful scientific endeavors have had one man ramrodding them through. The Hubble was a group-managed project. . . and thus became a horrible, expensive disaster.

The Manhattan Project seemed like a group effort, but there was one man fanatically following every detail. . . Robert Oppenheimer.

Entrepreneurs tend to succeed because they put their whole lives into their work. Groups tend to fail. Just ask the Russians.

None of the seven magazines and other businesses I sold should have failed. None would, I'm convinced, if there had been an entrepreneur running them instead of accountants. Why, it's almost enough to make a person think!

Dan Quayle recently attacked lawyers, pointing out that America has 70% of the world's lawyers. They're an easy target. . . and a valid one. But we need to wrest control of American industries from the accountants as well as the lawyers. Accountants should be there to help entrepreneurs know how they're doing, and should not be permitted to make financial decisions.

Corporations have to file tax returns and this means a horrendous amount of accounting has to be done for the government, which refuses to pay for it. These tax figures are almost useless as far as running a company is concerned. Entrepreneurs need to deal with cash flow, which includes things such as accounts receivable and payable aging.

The League, Again

With no-coders coming into the hobby by the thousands, there could be some opportunities for entrepreneurs to provide Tech-oriented products. But don't get carried away quite yet. While our growth appears to be about 100% ahead of last year at this time, remember that we still only have about 20% of the growth amateur radio experienced for 18 years after WWII . . . until the ARRL pulled the whole works to a screeching halt in 1964. While most of the chaps responsible for nuking the hobby are now dead, I'm not sure we shouldn't remind ourselves now and then of what damage the League has done and how little it's done to promote hobby growth. Sadly, there are thousands of amateurs who truly believe the self-promoting propaganda they put out. I've never loved or hated the League. I've just been amused by those who do love or hate it. That's about as smart as loving or hating the Republican or Democratic parties.

Yes, of course the League does good things. Always has. Unfortunately, as a ham editor and publisher for the last 40 years, I've been privy to the inside skinny on what's really been going on, something few hams outside the industry have any way of knowing. A little quiz: How much do you know about the Doyle letters? He was an ARRL director who really spilled the beans. They were busy trying to cover up that mess for years.

And why did Herb Hoover resign as president of the ARRL? And how was the ARRL involved with W2AOE's suicide? How did a sneaky (and probably illegal) ARRL deal with Hallicrafters completely ruin the ham exhibit at the New York World's Fair? Tell you what—if you'll get off your butt and elect some new and younger directors, I might shut up about the ARRL.

No, I'm not mad at the League. Exasperated perhaps, when I see the things that need to be done that they're not doing. And I sympathize with David Sumner, whose hands are pretty well tied by the directors, few of which have much business experience or detectable foresight.

I was just listening to a tape of an ARRL president giving a talk to a ham club where he admitted under questioning that the published board minutes in *QST* are laundered. Perhaps whitewashed is a better term. Having gotten years of earfuls from frustrated directors, I knew this was true, but I'd heard many true-believers angrily deny that any such skullduggery was possible.

When I asked Budlong W1BUD, the ARRL general manager, why the League was fighting the proposal for RTTY to be permitted below 2 meters, he explained that the League had always fought any rule-making proposal not submitted by them, no matter how beneficial to the hobby. Otherwise the League might lose control. I can't recall when the League has deviated from that policy in the 50-plus years I've been a member. Either you get your rules changed through the League or face an endless fight with them. Years later Bob Booth W3PS, their attorney, confirmed that this policy was still basic.

We succeeded in getting RTTY on the low bands, but it took several years of fighting the League. And look how long it took to get a no-code ticket!

So, following in my father's and grandfather's footsteps, I've been an entrepreneur most of my life. I've tried to help amateur radio grow and be more fun. No, I don't take it very seriously. But then I don't take anything very seriously. I try to call a spade a spade in my editorials and talks and encourage hams to have fun and keep our hobby clean. On that measure I guess I have to admit to being a failure. Oh, I've helped with the fun, but our hobby isn't much cleaner than it was 60 years ago. It isn't much worse, either, so perhaps that's a success, considering how much worse almost everything else in the world seems to have turned.

As my 69th birthday passes, I'm more and more aware of my mortality, with so many of the Silent Keys much younger than me. I'm discouraged that there don't seem to be any other voices speaking up for our hobby. The pages of *73* and *Radio Fun* are wide open for intelligent, creative ideas on improving amateur radio. Hello, anyone alive out there?

New Use for CB!

The Scripps Clinic In La Jolla has been messing around with 27 MHz. Lord knows how they got onto this one, but they've been sticking 27 MHz radiators into the mouths of 30 insomniacs for 20 minutes three times a week. Another 30 got no RF as a control. Wouldn't you know that the insomniacs went to sleep 52 minutes faster than the controls and slept 1.5 hours longer!

The next time you hear some old fossil beefing about CB you can point out that it has at least one sterling virtue . . . it puts people to sleep. No wonder, I often find that just listening to CB puts me to sleep.

Now I'd like to know what power levels they're zapping those insomniacs with. . . and if they've thought of testing 27 MHz against 30 MHz? Who knows, 10m may be an even better sleep inducer.

This bit of esoterica was reported at the annual meeting of the Bioelectromagnetic Society. I'll try and find out more about this for you. I don't have any trouble getting to sleep, but judging from some of the late night QRM, others may. . . so perhaps a 10 meter lollipop could help get you to the Land of Nod.

Are You Bo-ring?

Even packet and RTTY contacts can be excruciatingly boring when you run into a ham who has absolutely nothing to say. A recitation of the equipment, weather report, and signal report don't make much of a QSO. When that happens you know you're up against still another slow-witted proof that they don't give intelligence tests along with the code test.

One of the things I particularly enjoyed about RTTY back some 40 years ago was the ability it provided me to write some interesting stories and store them on punched tape. I've suggested doing this with tape cassettes, but it hasn't caught on. Today it's simple to store any number of stories on floppy disks and download them onto packet or RTTY. . . if you ever take the trouble to put them together.

Have I ever told you about the time when my fast-thinking saved my submarine from being sunk? Or the time when I came that close to being killed by the Shifta while on a hunting safari in northern Kenya? Or the time a drunk tried to stab me in the heart with a hunting knife? Or my strange first contact with China? Or some of my hairy flying experiences with my own seaplane? What it was like when I operated from Swaziland and Lesotho? Or from the king's palace in Jordan? Or the biggest crook I've ever met in amateur radio?

I'd love to have these recorded and quickly available to play, but even DAT tapes take 10 to 20 seconds to cue up. We need something faster, so I'm looking forward to Sony's new minidisc (MD) technology, where I'll be able to record over an hour of stories on a tiny disc and access any track I want in one or two seconds.

Using the same medium I'll be able to use either voice or an ASCII file and dump it via CW, RTTY, AMTOR or packet. I don't know how popular MDs will be for music, but they could be a boon for hams.

Of course I'm presuming that you have something of interest to talk about. That you've seen some interesting movies, watched some interesting TV shows on PBS, read some interesting books. . . etc. Alas, a dismayingly large percentage of the public doesn't or can't read. Plus they've never gone anywhere or done anything.

If you'd get your station set up for a combination of packet and slow-scan, you'd be able to set up whole libraries of short slide shows, complete with commentary, all accessible via a menu by the chap you're in contact with. Then, instead of just telling you about my visit to the Palace of Nebuchadnezzar, a few miles from Baghdad, I could show you some fascinating pictures, too.

Or perhaps you'd like to see how they bake pita bread in Tehran by sticking the loaves to the sides of igloo-shaped ovens? Probably not, eh? Well, how about some slides of sharks, barracuda and gorgeous coral? Or lionfish in the Red Sea? Or my DXpedition pictures from Navassa in 1958 or 1973? This isn't quite practical yet, but it could be within a year if someone would do the software.

A recent letter from Walt AH6HU suggests it's about time for some concentration on developing ham software. We need some macros to simplify log keeping and combine it with QSO files. We need to be able to make satellite or *Mir* contacts without having to shuttle between satellite tracking, log-

ging, and word processing programs . . . loading and unloading, with attendant waits for our struggling processor to wade through the top-heavy software. If you'll get started writing some software we can publish, we'll even help by making it available both on floppies and via our BBS.

The more we can use our computers and other storage systems to enhance our QSOs, the more fun amateur radio will be, both for us and for the people we get in contact with. Let's head toward multi-media, using packet, voice, computer storage, SSTV and so on, gradually getting ourselves into the 1990s in technology. And let's start seeing some articles from you on how to do it.

What's Been Your Contribution?

What are you really good at? Is there anything where you're a local expert? A national expert? A world expert? Any skill or field where you stand out? Or are you satisfied to be mediocre? Are you a star in some field . . . or just an anonymous cypher?

In amateur radio each special interest has its stars: W3CUL for traffic handling; W2QHH for certificate hunting; W6AM for DXing; W2BFD for RTTY; W8JK for antenna designing; W6KG for DXpeditioning; W1FZJ for Moonbouncing; W2KPL for ATV.

What separates the stars from the mediocre? Passion. Passion goads the star into working a little harder and longer than anyone else in one niche. It's surprising how little extra effort it takes to begin to stand out in your community . . . in your company . . . in your club.

I got fascinated by the idea of digital communications (RTTY) back in 1948. By 1951 I'd gotten so fed up with the lack of communications in the field that I started a newsletter . . . *Amateur Radio Frontiers*. Soon I was an "expert" and was asked to do a column in *CQ*! I started giving talks to ham clubs and wrote the first RTTY manual. My RTTY column led to my becoming the editor of *CQ*.

Is mediocrity genetic or is it learned? When there's a call for help by your ham club, are you right up front, anxious to do something? Club presidents are always complaining that 90% of the work for the club is done by 10% of the members. In which group are you?

At work . . . whatever kind of work you do . . . are you satisfied to be mediocre? How many magazines do you subscribe to which will help you learn more about how to do your work? How many books have you bought in the last year on the subject? How about adult educational courses in nearby schools? How about professional symposiums and conferences? If you're not taking them, should you at least be teaching them?

What aspects of amateur radio are you into? Tried packet yet? If so, have you given any talks to your club on the subject to try and get other club members interested? Ditto satellite communications, moonbounce, UHF experimenting, ATV, SSTV, and so on. Or are you a mediocre ham with only the most vague understanding of 90% of what the hobby has to offer? Are you merely a rag-chewer, satisfied to get on the air and mindlessly repeat the same garbage over and over for years?

If you're in sales, could you get up in front of a sales meeting and teach a group of salesmen about selling? If you're a manager, are you up to teaching a management group about managing? Or have you been getting by without really knowing much about your craft . . . without reading about it daily . . . without trying to learn more?

There's a big difference between getting very good at something and becoming a true expert. My rule of thumb has been to work at a new skill or interest until I'm in the top 10% of a group of people involved with that interest. After that, the amount of time it takes to get better at it starts to escalate logarithmically and you're headed toward being a one-interest person.

Let's say you decide for some weird reason to get good at working DX. You'll find there are few guidelines in the ham magazines about this. Even the DX bulletins don't cover the subject. They're almost 100% involved with lists of rare DX stations, their QSL managers, times and frequencies.

Okay, how good do you want to be? Some hams are so totally involved with working DX that they are monomaniacal on the subject. A rare DX station will keep them home from work . . . even from their son's graduation. I'd suggest setting a goal of 300 out of the 400 possible countries. That'll put you well up in the 10% stratosphere in most DX clubs.

If you're going to work 300 countries you're going to need time, good equipment and a lot of expertise. You can make up for any shortcomings in one department by spending more time in another. Howie W2QHH got to the top of the certificate-hunting pile more by dedication to his pursuit than by having a big signal. But a big signal will sure cut down on the time it takes. And it's more fun with a big signal.

It doesn't take much power to get through on a clear channel, so why the kilowatt and the beam? That's to clear the channel. You can't get to be a superb photographer with a Brownie. So figure on spending some money on your interest, whatever it is. Get good equipment. If you're into music, get a damned good hi-fi system. If you're going to rack up a DX score, put up a good, high tower, crown it with a single-band beam, add a kilowatt amplifier, and you're ready to start clearing your frequency . . . to jump into the pile-ups and come out with the prize while you're still smiling.

Your big signal is fine. That's like having a Weatherby for hunting (Weatherby was a ham, by the way). You still have to know where to hunt and how to find that elusive prey. This means getting DX bulletins. It means checking into the DX nets. It means a 2 meter link with other DXers. It means getting damned good at winning DX contests, for that's when some of the really rare spots are activated. That's

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when your big signal will pay off.

You still have to learn operating tricks. How to tail-end without aggravating the DX op. How to get your call across fast. How best to come out on top of the piles. How to find the rare ones. How best to deal with list operations.

Sure, I've worked something over 350 countries . . . and I did it without losing my perspective . . . without becoming a DX addict. If you've got a good signal you should be able to work a hundred countries in one DX contest weekend on 20m SSB. I did. Two hundred took me a month. Three hundred a year. From there on I stopped being serious about it and caught the rest by accident.

I went about learning to be a competition driver the same way. I got a good car (Porsche), took lessons from some top racing drivers, and practiced on some top race tracks.

Same with rallying. I got the best in equipment, drove for some top navigators to learn, then developed my own rallying system and then started teaching it to other navigators. The next thing I knew I was importing special watches and computers for rallying and advertising them in the car magazines. I developed my own special tables for navigators and those using my system were usually the winners.

Once you're over 300 countries it's time to ease off and start using your big signal for less predatory purposes. It doesn't hurt to have that signal for RTTY or packet. Or you might get involved with contests and start collecting awards. Once you get good at contesting, it's fun. Oh, it's a real bummer for the hams who just want to ragchew, but contests only come on about 50 weekends of the year, so don't pay any attention to those milksops. Ignore them. Crush their pitiful bleats with your Big Signal.

Once you get used to no longer being mediocre you'll find yourself getting elected president of your ham club . . . or any other club you join. And that's fun, too. It's a challenge. Now you're in show business. And once you're more than mediocre you're going to be a lot more interesting to talk to on the air. You're going to have interesting things to say. You're not going to be stuck way down there in that sorry rut of reciting your name (oops, pardon me, handle), rig, antenna, weather, and over to you.

40 Years?

Yep, I started publishing my first ham magazine 40 years ago, in June 1951 . . . complete with long editorials. I did it because I couldn't get anyone else to do it . . . and it needed to be done.

In 1936 I was just another fat 14-year-old teenager. Then an angel . . . or perhaps a devil, depending on your perspective . . . stepped in. My boyhood chum, Alfred Lake (Alfie), and I were in church (Dutch Reformed) one Sunday when a chap came in carrying a big carton of radio parts. Rather than throw them away he gave 'em to Alfie. Alfie took one look and asked if I was interested. Sure!

We read about angels coming or being sent down by God to do good things. But the Devil himself seems to get involved with the bad things. I guess he doesn't have as big a staff . . . or maybe as much to do. Yet, when you consider the number of bad things happening compared to the good, El Diablo must run a very tight ship. I don't believe for a minute that government employees go to heaven, but God must be using a similar management system.

Anyway, the box of radio parts got me to checking my *Popular Mechanics* back issues. I found an article on building a cigar-box radio which used my parts and put it together. Then either one of the best or the worst things of my life happened . . . it worked! I was hooked.

My high school (Erasmus, in Brooklyn) had a radio club (W2ANU), which I joined. Naturally I started studying for my ham ticket . . . and eventually became W2NSD.

Cut to 1948. After four years in college and another four in the Navy (WWII), I was working as chief cameraman for WPIX-TV, the *Daily News* station in New York. I set my 2m ham station up on the 37th floor, complete with a 16-element beam on the roof. Big stuff in those days.

But hey, what was that weird beedlebeedling up on 147.96? Turned out to be John Williams W2BFD and a bunch of other RTTYers talking with each other. Hmmm, Teletype, eh? It didn't take long before I'd built my first RTTY unit and was pecking away on a Model 12.

There was quite a crowd on the channel, all with automatic start and stop RTTY systems so they'd work just fine unattended. We had clocks on 'em which allowed us to selectively call any individual at so many minutes after the hour. If we turned on his machine during the one minute interval we could hold it on and leave messages. Several of us even built in a system to get an answer-back acknowledgement that the messages had been received. Not bad for over 40 years ago, eh?

I was having so much fun that I wanted others to find out about it so they could have fun too. I tried to get John to start a newsletter, but the best he'd do was send out bulletins on RTTY. Well, that wasn't going to help attract newcomers! We needed an RTTY newsletter.

In 1951 I got a job as a TV director at WXEL in Cleveland and, wow, there was a mimeograph machine. Within days I had the first issue of a Teletype bulletin in the mail to everyone I knew who was involved with this obscure hobby. I called it *Amateur Radio Frontiers* and published it monthly until I took over as editor of *CQ*.

My newsletter soon got me a RTTY column in *CQ*, and that led to me becoming the editor in January 1955. Then, when I got fired in January 1960, I decided to stick with publishing. The first issue of *73* came out in October 1960.

Continued on page 82

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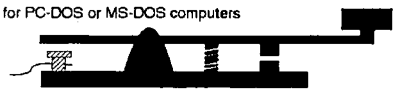
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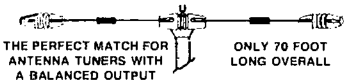
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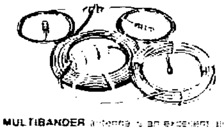
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Continued from page 79
It was that confounded box of old radio parts that started it all. When friends found I was interested in radio they started dumping old radios on me. I had a ball taking them apart and saving the parts. If I'd only known that putting 'em up in the attic for 50 years would turn them into solid gold...! But then, I'd have done a lot better job of saving my Big-Little books, my baseball cards and old marbles too. Heck, I could launch several more magazines just by selling all that old junk.

One legacy of my many years spent at the workbench building things is a twisted pelvis. I tended to stand on my right foot and this eventually gave me a slight permanent twist and a resulting weak back. I suppose it was a reasonable trade-off, because I had a wonderful time building rigs, receivers, audio amplifiers, RTTY, SSB, VHF gear and so on.

Parts? Did I have parts? I had tons of 'em. It took two moving van loads to get 'em to New Hampshire when I moved up from Brooklyn in 1962. I had thousands of tubes, cabinets full of resistors, capacitors, switches, relays, sockets, connectors. When I needed something I'd get a dozen or 50, just to be sure. I didn't just have switches or connectors, I had 33-drawer cabinets of switches and connectors.

I saw the beginning of the end when transistors and ICs appeared, so I held a couple of mammoth auctions and dumped everything at cents on the dollar, more interested in finding good homes for my parts than getting money for them. You don't sell things you love for money. I still remember every one of those parts...the Sangamo transmitting capacitors, the vacuum capacitors, those cute little 454 acorn and 9001 peanut tubes, remember nuvistors? How about those 815s? 826s...two 807s in one envelope? One rig had 203Zs, another 813s. My 2m kW had CX-125s.

Oh, there are plenty of things to build these days, but not rigs. Home building can't begin to compete with the economies of scale of commercial manufacturing. Individual hams have a hard time out-designing whole labs of engineers and technicians at ICOM, Kenwood and Yaesu.

With parts so hard to find it's easier to turn to Ramsey and other kit suppliers and let them shop Asia for us.

My first job after college was as a radio announcer/engineer. That was fun, but it didn't seem to have much of a future. I felt the same after trying television for three years. But my basic need was to get people to share the things I enjoyed, so publishing seemed like a good medium for me.

I've been at it ever since, encouraging kids to get into ham radio...trying to get hams to find out how much fun RTTY, SSTV, packet, 10 GHz, DXing, DXpeditioning, moonbounce, OSCAR and so on can be. Yes, I'm a nag.

When repeaters came along I drove tens of thousands of readers crazy pushing them to try 2 meter FM and repeaters. I did the same with SSB when that first came along. And computers too. I not only badgered my ham readers to try computers, I started one computer magazine after another, driving over a million readers to learn more about 'em and have fun. I published dozens of books and hundreds of software packages.

Now I'm sharing my love of music with my *Music & Audio Reviews* magazine, urging them to just dammit listen to ragtime, bluegrass, marches, folk, and a wide variety of ethnic music. And, as usual, I'm succeeding.

At 69 I have what, maybe 10 years more to go at best? Well, that's 10 years to help people have fun. And since one of the least fun things is to be poor, I also push anyone who'll read or listen to get off their butts and start making money. It's out there by the carload, just waiting for anyone with the guts to go after it...and that's fun too. It's exciting!

Making money doesn't take brains or even a college degree, all it takes is working in a direction which has good odds for a payoff...and working harder than most other people. At 69 I'm taking it easy. Heck, I seldom work more than half a day any more. Twelve hours. I can't let work eat into my hamming time, right? Hmmm, as the publisher of *73*, perhaps I should count hamming as work. No, that would put me on overtime.

Beating The Bushes

I'm heartened by the growing number of clubs which are actively trying to recruit new hams...particularly youngsters. My apologies for being such a nag about getting more hams. I'll be even more heartened if (a) you start sending me some photographs of your newly licensed youngsters and (b) you increase your efforts.

If your club would like to start Novice or no-code Tech classes, but you don't know how to get 'em out of the woodwork, I can give you some hints. Like hint #1 is to make sure you have interesting meetings so that when you get newcomers to come they won't be turned off forever about our hobby.

While I know it's possible that an old-timer could actually force himself to be nice to a youngster and manage at least a strained grin for a few moments, you might do better to retire your fogies to the back row and get someone with life left in 'em to front for the club. You old fogies can get mad at me if you like, since I'm probably older than you.

Okay, now how do you drum up those newcomers? Well, there are two ways to go about it, so do both of them. You can go hunting for them in the most likely places...on CB and in schools. It won't hurt to see if some members have kids who haven't yet been turned into fanatical ham haters.

I'd get a team of two or three club members to scout the CB channels, looking for fresh blood. If you get to 'em before they get disgusted and quit, you'll have a chance. Invite them to a club meeting. And when they come, for heavens sakes say hello to them. Talk to them. Get your members to come out of their huddle over at the side of the room and be gracious hosts. Jeeze, do I have to explain the fundamentals of good manners? Judging from many of the clubs I've visited, yes, I do.

I gave a talk about amateur radio to the fifth graders in the local school. They started a ham club and I'm still getting letters of appreciation from the kids. I wrote about that and asked if anyone had a spare rig for the club. No one wrote. Tsk. If you won't even part with a rig you're no longer using, at least put in your will to have your widow send one of your rigs to help out the kids.

If I can do it, so can you. So get in touch with your local schools and ask the principals if you can talk to the fifth or sixth graders about amateur radio. Mention that kids need to learn about technology...and they'll learn best if they are enthusiastic about it.

Yes, I know, that's old ground. Sure, but the fact is you haven't done it yet, so I need to remind you. When it comes to things you should be doing, but which take a little initiative, I have to nag the heck out of you. Now get moving! Heck, if I can find the time, so can you. You're *not* busier than I am.

Publicity

One of the easiest things you can do is start getting people acquainted with amateur radio by getting it mentioned in your local papers...and on the radio. If you know how to do this, it's simple. If you don't, you're in for a lot of frustration.

First, you need to have some sort of flimsy excuse for sending out a "release." This can be when a member of the club makes DXCC, WAS, wins a contest, when the club does Field Day, has a picnic, auction, hamfest, or other event, graduates some new licensees, holds a transmitter hunt, provides communications for a race, rally, walkathon, has a celebrity speaker (like an astronaut...no, I'm not a celebrity ...of course I could immolate myself on the front lawn of the White House in protest over the loss of 40% of 220 and become a celebrity, but who needs a talk from a roast ham?).

Do some brainstorming for possible news items. How about a club member making a 10,000 mile QRP contact with a rig he can hold in the palm of his hand? Or maybe someone has made DXCC over a weekend? Or WAS in one night? Or WAC in 10 minutes? How about some contacts with hams in the USSR? Or the Mideast?

Did I ever tell you about the time I worked W7IMW/C7 in Tiensin, China? He was running 1/10th watt to a signal generator and a longwire on 10 meters! Tell me about QRP. And yes, I worked a hundred countries on a weekend, worked all states one night, and made WAC in ten minutes one morning on 20 meters. No, I didn't call the newspapers...but I should have!

It's unlikely the paper will send out a reporter or photographer, so you'll want to get a club member to take the pictures...black and white, not color, for most papers. Color pictures don't do well in black and white.

Perhaps I'm presuming too much if I suggest that you may have someone in the club who can write. Many of the letters I get are on spiral notebook paper, written in something between hieroglyphics and Sanskrit. The easier a release is for an editor to use, the more likely it is to get published. I hope that's not a revelation.

This means you appoint a literate club member to write the release. Print it out double-spaced, keeping it concise and to the point. Include the floppy disk so the editor won't have to re-keyboard it. The less editing it needs, the more likely it is to see print. Tell the story simply and clearly. Leave out the ham lingo. Try to work in how much fun everyone had at whatever you're writing about and give a contact name and phone number, both for the editor and for any readers wanting information about club meetings.

Once you have your release ready to go, complete with some photos (each with a caption taped to the back...do not use a ball pen), it's time to call the editor and tell him you're sending a release. Tell him if he has any questions to give you a call.

Then, when you think he's had time to get the release, call again and see if he has any questions. You can then ask if he's going to run the story, so you can tell the club members and their families to look for it.

Be sure to include the fact that the club is giving license classes and that newcomers are most welcome. Then see that they are.

One more thing, try to get across the idea that you're having fun.

If you keep getting our hobby into print and mentioned on the radio, eventually the concept that hamming is fun and accessible will seep into the public consciousness. With over 3,000 ad messages a day hitting us, it isn't easy to get through the clutter. It takes imagination and persistence. One time doesn't do a thing. Two times doesn't either. It takes a continuous barrage to penetrate.

When I lecture college students on entrepreneurialism I always ask for a show of hands of those who know what amateur radio is. I'd say that about 5% of them even have a clue. And it's our fault that we have an almost totally secret hobby.

One of the things I pleaded with you ARRL members to do is to lean on those old dodo directors you keep electing every two years and get them to have the general manager set up an honest-to-goodness PR department to go after both national and regional publicity for the hobby. And keep leaning until they stop double-talking and get into action.

Okay, you have your marching orders, what else do you need? Let's get cracking...and don't forget to send me a copy of your stories when published so I can start giving your club credit. 73

HAMS WITH CLASS

Carole Perry WB2MGP
P O. Box 131646
Staten Island NY 10313-0006

The Berens River Connection

As a ham radio operator, I am always fascinated with the way every radio contact can produce its own unique fun, excitement, or information. As a teacher using ham radio in the classroom, I continue to be impressed with the myriad of spin-off lessons that can be generated from the simplest of radio contacts.

Without even realizing it most of the time, hams are always demonstrating skills other than radio expertise. Determination, diplomacy, good will, cooperativeness, and helpfulness are but a few of the very real observable traits most hams convey to the world 24 hours a day. How wonderful it is to be able to point this out to children who are at the radio.

When Bill Peckham VE4AAL, principal of the Berens River School in Manitoba, contacted me, neither one of us could have predicted the excellent exchanges our schools would be involved with. Bill and his students tried to check into our CQ All Schools net for months. We always called for them, knowing that they would be there listening for us. When we finally did make contact, it was especially meaningful to all the youngsters. Phrases like "ham determination" and "never say die" were heard in my classroom for days as the children discussed the contact.

The children, being natural goodwill ambassadors, quickly set up a pen-pal exchange with their counterparts in Canada. Many class sessions in the next few months were spent on producing a schoolwide video to send to Bill and his students. We continued to be surprised and amazed at the differences in our respective schools. When my students in Staten Island learned that Berens River had a total population of 1800 people, their jaws literally dropped. The school population in our 6th, 7th, and 8th grade intermediate school alone is 1800. It was great fun for me to watch the expressions on their faces when they heard these facts on the radio. The video tape and letter exchange will undoubtedly be remembered for a long time. If you are lucky enough to be an instructor with a ham radio in your classroom, don't cheat yourself and your students out of this kind of terrific learning experience.

From VE4AAL: Report on Student Ham Radio

Berens River is an isolated community located 180 miles directly north of Winnipeg, Manitoba's capital city. The community is accessible by road only during January to March, when vehicles can drive over the frozen lakes, rivers, and muskeg. During the summer, Lake Winnipeg offers passage for barges and fishing boats. Excellent airport facilities allow small commercial airlines to fly in and out on most days. Isolation is a factor shared by many northern Manitoba communities.

Berens River First Nation Reserve has approximately 1800 residents, most of whom are Treaty Indians of the Saulteaux Tribe. Many of the students speak Saulteaux fluently, and have the opportunity to study their language at school. School programs encourage respect for their local heritage and culture.

Berens River School is operated by Frontier School Division No. 48, and costs are shared with the local Native Band. Frontier School Division is the largest school division in total area, in North America, and covers many remote communities. The Area 3 superintendent has been most supportive in encouraging new programs, like the Ham Radio Pilot project, which will hopefully help advance communications in these northern communities. Student interest could develop into lifelong hobbies, and perhaps lead into various careers. Many students have been introduced to radios because their parents operate marine radios on their fishing boats in summer when the boats head out on Lake Winnipeg. During winter, when the fishermen use bombardiers on the frozen lake, marine radios are essential equipment.

In the fall of 1990, the ham radio shack in Berens River School received a new rotor and control for its large-sized, heavy beam antenna. The Berens River Band Council gave the school a large steel tower on which to mount the beam. This antenna allows global coverage of the 10, 15, and 20 meter bands. Another antenna, an inverted-vee, allows contact on the 40 and 80 meter bands. The ICOM 735 transceiver provides state-of-the-art radio contact with the outside world. The ham radio pilot project in our school includes classes in grades 5, 6, and 7. This program has been slow at getting off the ground, but more volunteer students are getting involved from these three classes. Morse code keys have been received to practice code so the students are well on their way toward learning the alphabet. The students often meet during regular class time and have been spending more time during lunch hours and after school.

The highlight of our ham radio program thus far has been the 6th and 7th grade students' recent contact with Carole Perry's students in Staten Island, New York. We had often tried to connect with them last year, but without success. For most of our students, it was the first time they had spoken into the mike. By the time we made our second clear (5/9) contact, the students were able to give their names

Photo A. Berens River School Principal Bill Peckham VE4AAL at the school rig.

Photo B. Fifth grade students watch as Kingsley McDonald speaks on the radio.

Photo C. Eighth grade students Farah Berens (at the mike) and Arnold Disbrowe learn how to make QSOs.

phonetically over the mike, and were quite excited with the matching of pen pals. Some students were apprehensive about their poor writing skills, but were reassured that they would receive extra help with letter writing. They were willing to try, and have nearly completed their rough drafts. We've received our first pictures of Carole's students, and have Polaroid pictures of our own students in the mail.

The students are eager to learn more about New York City, our contact area. They weren't too sympathetic with Carole when she mentioned the snow storms in New York, as we had experienced blizzards with −40 degrees Celsius during the holidays. The wind chill sometimes made it more like −50 degrees. Students in Hollywood, California, talking on Carole's net during our first contact certainly couldn't comprehend these conditions.

Dave Place, a guest instructor, recently visited our school while in our community on business. He explained to the students the theory of how messages are transmitted from the radio through the atmosphere to other locations. Within minutes, Dave had several students talking to people in England and Wales, as well as listening to people in Italy. What a way to integrate studies! It is most encouraging to hear students who have never had much academic success spell their names phonetically on the radio, and do their best writing a letter to a new pen pal!

Our next challenge is to have our 5th grade students talk with Larry, a teacher in Hawaii I made contact with several times last June, and his students. Through such contacts, our students are beginning to understand the concept of time zone differences.

My latest challenge to the students is the offer of a free ham station to the first student who passes his or her Novice ham exam. One young lady asked me what I would do if several students passed the exam at the same time. Do they each get a station? I hadn't thought about that!

In the future, we will have to address several needs. First, we need to identify and obtain learning materials (books, publications, Apple IIe computer disks, and video tapes) suitable for our students, to help prepare them for their Novice ham radio exams. Second, we need more instructors, as the increased interest among other students means an added strain on the instructor's time.

Considering the advantages and educational benefits to the children of the Ham Radio Project, the time, money, and effort makes everything worthwhile. 73

All hams are encouraged to use this column as a focus and reference, and to send in suggestions and ideas so that we can share and network with each other on ways to promote amateur radio to capture the interest of people of all ages.

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UPDATES

Pseudo CW Filter

See the above article in the June 1991 issue, page 18. Several pinout numbers in the original schematic need to be changed to reflect the PC board pattern: pinouts 4, 5, and 6 should be 10, 9, and 8, respectively on U3. See the Figure for the corrected schematic.

Although the CW filter will work with the incorrect pinouts above, it will not work without the junction of C8 and C9 going to ground. Note the ground in this new schematic. Note, however, that the PC board layout is correct. TNX John Korzenko KB5JOZ for calling this to our attention.

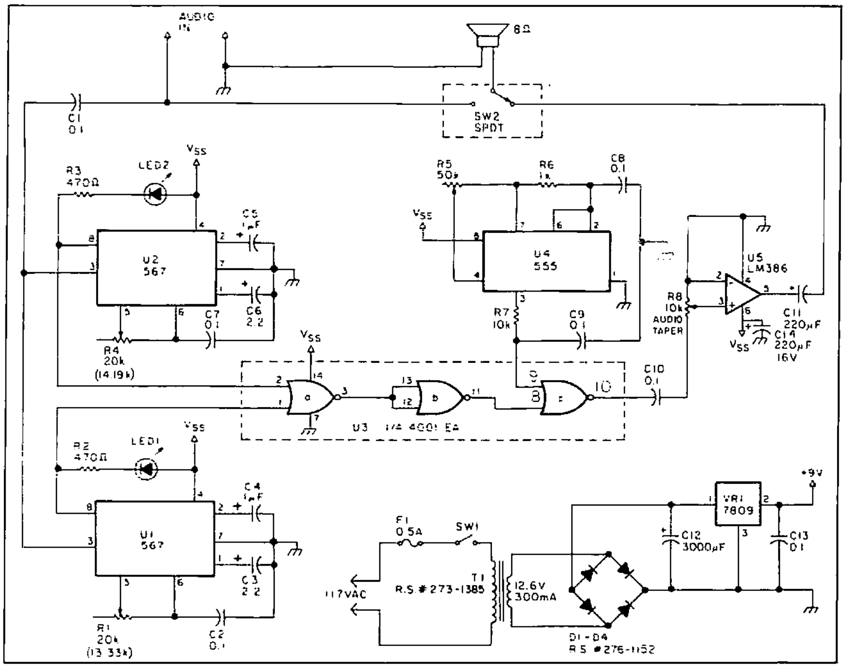

Figure. Corrections for the Pseudo CW Filter are shown in blue.

Poor Man's Packet

See this article in the August 1991 on page 8. Wm. Kresl WB9BBC writes that he and Jim N9EDX have discovered an easier method of aligning the modem RX BIAS adjustment. The procedure is as follows:

1. Disconnect the 33 ohm load resistor (R6) from the RX audio input line.
2. Temporarily jumper the TX audio output line to the RX input line.
3. Enter the PMPTEST software and run the 600 Hz transmit audio test.
4. Place a scope on the RXD data line of the modem chip (pin 8). The transmit data consists of perfectly timed square waves (duty cycle wise).
5. Adjust the RX bias pot (R1) for perfect 50% HI and 50% LOW duty cycle pulses. This is a critical adjustment made simpler with the scope.
6. After adjustment, re-connect the RX load resistor (R6) and remove the temporary jumper.

Says WB9BBC, "I also used a scope to set the TX audio output modulation to the HT to approximately 20–50 mV (peak-to-peak). I have built and tuned up five modem boards since, and the procedure works fine." TNX Wm. Kresl WB9BBC. 73

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The *73 Flea Market*, Barter 'n' Buy, costs you peanuts (almost)—comes to 35¢ a word for individual (noncommercial) ads and $1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

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This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

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73 INTERNATIONAL

Arnie Johnson N1BAC
103 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I am writing this during the last week in August. As we all probably remember, there was an attempted coup in the Soviet Union to remove Mikhail Gorbachev from the Presidency of the Soviet Union. As usual with world events, hams were involved in the happenings.

In the United States we were shown video footage on the television of what was happening in Moscow. One of the stories showed the office of Boris Yeltsin, President of the Republic of Russia. A portion of the report showed that an ICOM IC-735 was being used for communications on 14.167 MHz, a ham allotted frequency. [Editor's note: We just received a newspaper clipping from *The Morning Call*, an Easton, Pennsylvania, publication, on amateur radio operator Romeo Stepanenko 3W3RR, a resident of Moscow who kept Yeltsin in touch with the world during the three-day seige. In a FAX to William N. Goodman K3ANS, at whose home Stepanenko was a guest last year, Stepanenko writes, "Listen to R3A on 14.175 and 7.044, the only real and trusty information." Yuri Brajenko, who helped set up the shortwave station, said that the station also collected and retransmitted information from other parts of the country on the people's reaction to the attempted takeover. Helen Brajenko translated Russian to English on the air for Stepanenko. Yuri, Helen, and Stepanenko spent three days and three nights with a team of Russian ham radio operators on the sixth floor of the Russian Parliament building, keeping the world informed. TNX K3ANS for sending us this information.]

About the same time, the eastern seacoast was visited by Hurricane Bob. Usually a hurricane that could cause heavy damage would receive top billing in the media, but it came in second to the attempted coup in the Soviet Union.

A week following the hurricane, I was watching a program on one of our PBS (Public Broadcast Service) TV channels which showed the effects of hurricanes and what can be done by business owners and homeowners to minimize the damage from the winds and rain. In the program, a weather forecaster asked for more information from an affected area. He was talking to a person sitting in front of a radio. The readout on the front of the radio showed 14.325 MHz, a ham frequency in the United States.

I have listened to that frequency in the past during hurricanes and have heard the National Weather Service (NWS) in Miami, Florida, receiving reports from hams on conditions there. That information was very important because the data from the NWS in the affected area was unavailable due to a power outage.

Sometimes I have heard the reverse; the NWS has sent warnings to the affected areas by ham radio because all other communications channels were out due to weather related damage.

This points out that hams have been useful in many different ways in the past, and must be ready to assist at any time when the need arises. Now is the time to prepare for the future.—Arnie N1BAC.

Roundup

Japan From *The JARL News*: The International Telecommunications Union (ITU) has decided that a Plenipotentiary Conference will be held in Kyoto, Japan, for five weeks, commencing September 19, 1994. This is the first time that the ITU Plenipotentiary Conference will be held in the Asia-Pacific region, and more than 1,200 participants, originating from as many as 164 countries, are expected to attend.

Though the agenda for Japan has not yet been decided, a special plenipotentiary committee will hand over the subject of ITU reorganization, and the new direction of ITU will be discussed. Equally of importance will be the election of a new secretary general.

Taiwan Official Visits JARL. Mrs. Tsai S. Luan, a senior member of the Telecommunications Bureau of Taiwan, together with her husband, visited JARL's offices and met with the Secretary of the IARU, Region III, Mr. Fujioka, and the latter explained in general about amateur radio in Japan, and elaborated on JARL's various activities as well.

Their two-day visit (June 18 and 19) was, according to Mrs. Luan, very satisfying as she was given full details to her inquires about the Japanese system of qualifying amateur radio operators and licensing.

AUSTRALIA

David Horsfall VK2KFU
P.O. Box 257
Wahroonga NSW.2076
Australia

This is just a quick preview of the coming months. Briefly, there is agitation to remove the CW requirement completely for HF access, and replace it with further theory (e.g., advanced communications); and following the development of examinations to accredited examiners, the WIA looks to be the sole supplier of such papers, thereby putting a few noses out of joint. Finally, the packet protocol wars are raging again. This time it's ROSE vs. NET/ROM. Stay tuned for the latest!

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
Packet: 4X1MK@4X4SV.ISR.EU

Ministry of Communications News Speaking for the Ministry of Communications at the annual General Membership Assembly of the IARC, Mr. Alon Bar Sela 4X1AB praised the radio amateurs who came forward and volunteered their services at the Ministry's monitoring station in Jaffa, as well as those who relayed traffic for the American servicemen and women stationed in the Persian Gulf during the crisis and war.

Alon assured us that the Israeli delegation to the 1992 World Administrative Radio Council (WARC) will be a staunch supporter of amateur radio, and will do its best to defend our bands against the various interests who wish to take more slices of spectrum away from us.

The Ministry of Communications caught some pirates who had been causing interference to amateur communications, and seized their equipment and filed criminal charges with the police. Mr. Bar Sela stressed that it is difficult to catch such culprits, and even once things are before the courts it can take much time before sentences are passed. Nonetheless, being caught and having equipment seized is an unpleasant experience and a punishment in itself, as well as a deterrent to others. The Ministry would like to see more participation from the amateur community in this ongoing hunt.

4X1AB cited the opening of a portion of the 50 MHz band for radio amateurs in Israel, and said that this was a step in the direction of further increasing amateur activity here in that frequency range. In closing he congratulated the young amateurs who had just recently passed the Novice examinations, and said that with the expansion of Novice privileges we were seeing a greater influx of young people into our ranks.

Activity Thrives at the IARC Home Every Thursday evening the new IARC headquarters are bustling! Each week at this time interesting lectures are delivered mainly, but not exclusively, on topics related to amateur radio. Topics covered up to now include computer programs, packet radio, antenna tower construction and safety, electromagnetic radiation, and aircraft accident analysis.

Behind the scenes, organizing these different interesting talks, is Tuvia Greengross 4X4GT. It is said that Tuvia is an expert in arm-twisting, convincing members of our ham community, which it turns out is blessed with numerous experts in many fields, to give an evening's talk on the subject of their expertise.

Morse Camp in Haifa! For the first time in the history of Israel, a day camp is being held for the express purpose of teaching Morse code. From July 7th through the 18th, from 8 a.m. to noon, the course, sponsored by the City of Haifa, is being held at Beit Miller on

Continued on page 90

Photo. The President of the Govierno Autonomo, Don Lorenzo Olarte Cullen (seated), is shown with the president of the URL Club.

Number 26 on your Feedback card

SPECIAL EVENTS

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

NOV 2

ENID, OK The Enid ARC will host a Hamfest at Garfield County Fairgrounds' Hoover Bldg., Oxford St. and N. 4th. VE Exams begin at 10 AM, walk-ins welcome. Free parking, free table spaces. Dealer present. RV hook-ups. Admission $1. Talk-in: 145.29/144.69, 444.40/449.40. Contact ***Tom N5LWT, (405) 233-8473, eves.***

NOV 3

WESTMINSTER, MD The 2nd Annual Mason-Dixon Computer and Hamfest will be held at the Carroll County AG Center, Smith Ave. Limited overnight camping sites are available. Set-up begins at 6 AM, gates open at 8 AM. Admission $5. Tailgating $5. Inside tables $10. VE Exams. Contact ***Dennis Baldwin KA3IXG, (301) 239-3878***, or write ***PO Box 2099, Westminster MD 21158.***

NOV 6

CAMILLUS, NY VE Exams will be held at the Town of Camillus Municipal Bldg., 4600 W. Genesee St., starting at 7 PM. Test fee for Technician through Extra class is $5.25. Talk-in: 147.300. Contact ***John Patchett KB2ERJ, (315) 487-0298.*** Please bring two forms of ID and a copy of your license.

NOV 8-10

CHIANG MAI, THAILAND The Radio Amateur Society of Thailand will host the 19th annual SEANET Convention at the Chiang Mai Plaza Hotel. For reservation details write to ***G.P.O Box 2008, Bangkok 10501, Thailand,*** or check into the net from 12:00 Z on 14.320 and contact any HS station that checks in.

NOV 9

COOKEVILLE, TN An indoor Hamfest will be held by JVARN from 7 AM-3 PM. Set-up at 5:20 AM. Admission $2, tables $5. Location given on talk-in on 145.45 RPT. Contact ***Bill Ferrell N4SSB, (615) 452-3962.***

NOV 10

LONG ISLAND, NY The Radio Central ARC will sponsor HAMEXPO at Suffolk County Community College, Long Island Expwy. exit 62-Nichols Rd./County Rd. 97-1 mi. north. Free parking. VE Exams, seminars, forums. Admission $5 at the door. Tables $20 in advance. Send to ***Radio Central ARC, PO Box 680, Miller Place NY 11764.*** For info call ***John Mark KB2QO, (516) 689-6336*** or ***Jo Ann Coletti N2IME, (516) 399-1877.***

NORTH HAVEN, CT The South Central Connecticut ARA will hold an indoor Ham Radio and Computer Flea Market at North Haven Park and Rec Center, 7 Linsley St. Sellers admitted at 7 AM, buyers 9 AM-3 PM. Tables $15 in advance, $20 at the door. General admission $3 per person. Talk-in 146.01/.61. Table reservations must be received with check by Nov. 1st, no reservations by phone. For reservations and info, SASE to ***SCARA Flea Market, PO Box 81, North Haven CT 06473,*** or call ***Brad WA1TAS, (203) 265-6478*** between 7 PM and 10 PM.

NOV 16

PLYMOUTH, MA The Mayflower ARC will host a Flea Market at the Plymouth Memorial Hall Bldg. In Plymouth Center (RT3A) from 9 AM-4 PM. Tables are $10 in advance, $12 at the door (if available). Sellers admitted at 8 AM. Donation $2, children under 12 free. There will be a Microwave/ATV demo. Talk-in: 446.625 and 146.55 simplex. Mail SASE and check with table payments to ***M.A.R.C., PO Box 766, Plymouth MA 02360.*** For info call ***Jon WS1K, (508) 746-0162*** or ***Jim NM1F, (508) 747-2224,*** eves.

MONTGOMERY, AL The Montgomery ARC will host the 14th annual Montgomery Hamfest in Garrett Coliseum at the South Alabama State Fairgrounds on Federal Dr. Free parking. Free admission. Set-up begins at 6 AM; doors open to the public from 8 AM-3 PM. FCC Exams start at 8 AM. Bring original and a copy of your current license, picture ID and $3. Talk-in on 146.24/.84, call W4AP. Ragchew 146.32/.92 (with phone patch, •up/#down), 147.78/.18, 449.50/444.50. Flea Market reservations are not required. Special Hamfest rates at Villagers Inn, I-85 at Ann Street ($28.50 plus tax, up to 4 folks). Phone the desk at ***(205) 834-4055*** or ***800-328-7829.*** For reservations at the Coliseum Motel, across the street from the Hamfest, the desk phone is ***(205) 265-0586*** or ***800-876-6835.*** For more info write to ***Hamfest Committee, c/o 2141 Edinburgh Dr., Montgomery AL 36116*** or phone ***Phil, (205) 272-7980*** (after 5 PM CST, or any reasonable hour on weekends and holidays).

NOV 17

CHICAGO, IL The Ham Auction of the Chicago ARC will be held at the DeVry Inst. of Tech., 3300 N. Campbell, from 12 Noon until all is sold. Door opens at 11 AM for sellers.

NOV 23

BILLERICA, MA An Amateur Radio and Electronics Auction will be held from 11 AM-4 PM at 300 Concord Rd. Free admission and parking. Seller check-in at 9:30 AM. Buyers admitted at 10 AM. Commission is 15 percent, $1 minimum, $30 maximum. No commission for owner buy-back. Contact ***Ellot Mayer W1MJ, (508) 851-0183.*** This event is sponsored by Bull HN 1200 RC and the Waltham ARA.

NOV 24

WHEATON, IL GMRS of Illinois, Inc., will hold our annual "Winterfest" at DuPage Co. Fairgrounds on November 24, 1991, from 8:00 a.m. to 1:00 p.m. Tables are $10 in advance, $12 at the door. Tickets are $4 in advance and $5 at the door, outdoor flea market spaces are available at no charge. Plenty of parking, no tables in hallways, no crowding. For more info call ***Bob (708) 690-1492 or write: GMRS of IL, Inc., 2077 W. Roosevelt Rd., Wheaton IL 60187.***

RICHMOND, VA PC Fest Computer Shows, Inc. will hold a Hamfest at the Virginia State Fairgrounds from 10 AM-4 PM. Admission is $6 for adults, children under 10 admitted free.

NOV 30

APACHE JUNCTION, AZ The Superstition ARC, WB7TJD, will hold its annual Hamfest at P&M Rodeo Grounds, NW corner Brown Rd and Meridian, from 7 AM-3 PM. Admission $1. Tailgate space $3 per space, overnight parking, no hook-ups. Talk-in: 147.72/.12. Contact ***Chuck Kruppenbacher, (602) 986-3060.***

SPECIAL EVENT STATIONS

NOV 2

URBANNA, VA The Rappahannock ARA will operate K3RZR, 1330-2130 UTC, to celebrate the 34th annual Urbanna Oyster Festival. Operation will be in the following bands: 20 meters: 14.140/.280; 40 meters: 7.240/.280; 80 meters: 3.860/.880. For certificate, send QSL and 8½ x 11 SASE to ***Phyllis Haxton N4VZC, PO Box 396, Burgess VA 22432.***

NOV 2-3

COOKEVILLE, TN The ARS of Tennessee Technological University, will operate Station WA4UCE from 1400-2400Z Sat. & Sun., in conjunction with the University's 46th Homecoming Celebration. Operations will be on the General portions of the 80, 40, 20, 15 and 10 meter bands and the Novice portion of 10 meters. For certificate, send QSL and 9 x 12 SASE to ***TTARS, Tennessee Technological University, Box 5262, Cookeville TN 38505.***

CHARLOTTE, NC The new Amateur Radio Education Center at the Discovery Place Science Museum will celebrate its opening by hosting Station W4BFB from noon EST Nov. 2-noon Nov. 3. W4BFB will be operated by the Mecklenburg ARS, primarily on phone in the bottom 50 kHz of the General phone subbands on 75, 40 and 20 meters, and around 28.400. For QSL and Certificate, send QSL card and a 9 x 12 SASE with two units of First Class postage to ***Ralph Eubanks KK4FC, 6021 Coatbridge Lane, Charlotte NC 28212, USA.***

NOV 3

LEGARTO, TX To help celebrate the medieval flavored AbbeyFest I, the Benedictine monastery of Corpus Christi Abbey and Benedictine Retreat Center, the Corpus Christi ARC, will operate station W5MS near the shore of Lake Corpus Christi, in Live Oak County, from 0000-2359 Z. Frequencies: Lower 25 kc phone subbands of the 84, 40, 20, 15, and 10 meter bands; RTTY on 20 and 15 m; 146.96-, 147.08+, 444.70+. For a QSL certificate, send QSL and a large SASE to ***Br. Dominic Mazoch, OSB, N5TCB, NCR 2 Box 6300, Sandia TX 78383.***

NOV 4-10

PENSACOLA, FL The Serious Hams ARC will operate 4 Nov.-10 Nov. to celebrate the decommissioning of the USS Lexington AVT-16. Operations will be in the lower portion of the General 80-15 meter subbands and 28.350. For certificate, send QSL and a 9 x 12 SASE to ***Mike Brown N4MAD, 519 S. Edgewood Cir., Pensacola FL 32506.***

NOV 7

CLINTON, NC The Sampson County ARS will operate Station AB4TT from 1700-2400Z for the Sampson County Expo and Pork Festival. Operation will be in the lower portion of the General bands. For certificate, send QSL and SASE to ***SCARS, PO Box 64, Clinton NC 28328.***

NOV 9

MEMPHIS, TN The Delta ARC will operate W4BS from 1400-0000Z in celebration of the grand opening of the Pyramid on the Mississippi. Look for operation at 14.305, 21.320, 28.455. For a nice, full color QSL, send SASE to ***Delta ARC, PO Box 16343, Memphis TN 38186-0343.***

Continued from page 88

Shoshanat HaCarmel Street, home of the 4X4HF radio club. Intended for youths, the fee is a mere 105 shekels (US$45).

Those diligently participating for the fortnight, even with no previous knowledge of the code, should gain at least enough proficiency to pass the Novice ham test. A fully-equipped ham station is on the premises, and part of the time will be devoted to operating procedures. We hope to get a follow-up this fall, when the Ministry of Communications exams will be held. Will this project yield a crop of new young hams?

SPAIN

Woodson Gannaway EA8/N5KVB
Apartado 11
35450 Santa Maria de Guia
(Las Palmas de Gran Canaria)
Islas Canarias
Espana

Ham Party. Any party among Hispanics is an excuse to get together and have a good time! Early in my stay here a friend was telling me about an upcoming party, and I made the mistake of asking him what time it would be. He replied, "To have a party here you don't need a specific time, only a day."

One purpose of a recent party was to award five insignia to stalwart members of the ham club. The requirements were: to have been a member of the club at least 15 years, and to be at least 65 years old. Another purpose was to award the "Diploma Islas Canarias" to all the EA8 ops who have earned it; fulfilling the requirements are much more difficult for EA8s than for hams in other parts of the world.

Plaques were also awarded to several collaborators and the president in appreciation for their many services to the URL. Several foreigners, such as YL (XYL?) CO5CB, a Cuban, received plaques as reminders of their stay among us.

Furthermore, an unusual note of thanks was given by the YL members of the URL to one of their members of whom they are very proud for her awards and achievements during the short time she has been participating in the contest world. In addition to some pretty amazing individual feats, she led the URL "contest team" to several world championships. Those of you who read this column may know that we can be talking of none other than Elsa EA8BVH. And so her YL companions awarded her a keepsake plaque.

Another reason for the party was to celebrate the formal reopening of the club after extensive remodeling of the building and grounds. This was attended by officials of the state government, as shown in the photo. The party was a great success with lots of good and lively music until the wee hours of the morning, but without the fireworks like we have on Independence Day in the United States (O.K., Luisa?). In all, a memorable night of April 27.

Oh yes, my call now is EA8/N5KVB, which is the uniform style in the Common Market countries for temporary licensees. I'm still in that category. Until next time, 73.

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 E. Chateau Circle
Payson AZ 85541

The November Blahs

As most of you know, the spring and fall months of the year, centered around the mid-March and mid-September equinoxes, are traditionally the best times for DX propagation. However, as the months progress toward the solstices of December and June, conditions gradually deteriorate on the long-distance HF hauls.

November is one of those in-between months, yet a time for contesting, too. What can we say about this November? Well, among others things, YY—EEE—CCC—HHHH and Blah, with a capital "B." That's a bit of an exaggeration, but I really don't see a lot of good days for HF band propagation.

The poorest conditions will be centered around the 8th of the month, and again around the 25th. The rest of the month will exhibit fair conditions, with occasional good days, as shown on the calendar, around the 18th through the 22nd. . .possibly five days in all.

But, On Other Bands. . .

What's sauce for the goose is not necessarily sauce for the gander, and I expect that the bands between 30 and 160 will be quite reasonable for night-time DX, and grayline (along the path of dawn and sunset) propagation will provide some excellent contacts.

The bands between 30 and 10 meters, will not be "too shiny," as a local friend of mine says. Of course, these are just guesses based on some pretty advanced crystal gazing, and I hope my pessimistic prognostications are wrong by a mile or more. Certainly, for the past six or eight months, Old Sol has confounded the experts and created some unusual propagation conditions. There is no reason to believe that that will change soon, so be aware that anything can happen, and possibly will . .from great to rotten!

Feedback Wanted

On the poor ("P" on the calendar) days, we may experience anything from radio blackout to difficult-to-read signals on the HF bands with loads of QSB. Perhaps some of the lower HF bands won't be as greatly affected. Characteristically, the signals on poor days will not have the sock they have on good days. On the days marked fair ("F" on the calendar), you can expect some good DX contacts between selected areas, but not everywhere. I wish it were not so, but that's the way it looks. I hope that some of you will call or write and tell me how wrong I was.

WWV at 18 minutes after the hour can be your guide to "conditions for the next 24 hours," but you'll find that even they don't always hit the mark. Look for low Boulder A (below 10) and Boulder K (below 3) and high Solar Flux (about 200) for your best chances. Let me know how it works out for you! 73

EASTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	[illegible]	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	[illegible]	—	—	—	—	[illegible]	[illegible]	—	[illegible]	20
HAWAII	[illegible]	[illegible]	20	20	20	20	20	—	—	—	—	[illegible]
INDIA	20	20	—	20	20	—	—	—	—	—	—	[illegible]
JAPAN	—	—	—	—	—	20	20	—	—	—	—	[illegible]
MEXICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	—	20	—	—	20	20	[illegible]	[illegible]	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	40	20	20	20	—	—	[illegible]	[illegible]	20	—	—
U S S R	20	[illegible]	[illegible]	—	—	—	—	—	—	[illegible]	[illegible]	20
WEST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

CENTRAL UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
ARGENTINA	[illegible]	[illegible]	20	—	—	20	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	—	20	20	—	20	—	—	—	[illegible]	[illegible]
CANAL ZONE	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	—	—	—	20	—	—	—	—	[illegible]	[illegible]
HAWAII	—	—	20	20	[illegible]	—	20	—	[illegible]	[illegible]	[illegible]	[illegible]
INDIA	[illegible]	20	—	—	—	20	20	—	—	—	—	[illegible]
JAPAN	[illegible]	—	—	—	—	20	20	20	—	—	—	[illegible]
MEXICO	[illegible]	20	20	20	—	20	20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
PHILIPPINES	[illegible]	—	20	—	—	—	20	20	—	—	—	—
PUERTO RICO	[illegible]	20	20	20	—	20	20	20	[illegible]	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	[illegible]	20	—	—	—	[illegible]	[illegible]	20	—	—
U S S R	20	20	20	20	—	20	—	—	[illegible]	[illegible]	[illegible]	20

WESTERN UNITED STATES TO:

GMT	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
ARGENTINA	[illegible]	[illegible]	[illegible]	20	20	—	—	—	—	—	[illegible]	[illegible]
AUSTRALIA	[illegible]	[illegible]	[illegible]	20	20	[illegible]	[illegible]	20	—	—	—	[illegible]
CANAL ZONE	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
ENGLAND	20	20	20	20	—	20	—	[illegible]	[illegible]	—	—	20
HAWAII	[illegible]	[illegible]	20	20	40	40	20	20	—	[illegible]	[illegible]	[illegible]
INDIA	—	[illegible]	[illegible]	—	—	—	20	20	[illegible]	[illegible]	—	—
JAPAN	[illegible]	20	20	20	20	20	—	20	[illegible]	[illegible]	[illegible]	[illegible]
MEXICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
PHILIPPINES	—	[illegible]	[illegible]	—	—	20	20	20	[illegible]	—	—	—
PUERTO RICO	[illegible]	[illegible]	20	20	20	—	—	—	—	[illegible]	[illegible]	[illegible]
SOUTH AFRICA	—	—	—	20	—	—	—	20	[illegible]	[illegible]	—	—
U S S R	20	20	20	20	—	—	—	—	—	—	—	20
EAST COAST	[illegible]	[illegible]	[illegible]	[illegible]	40	40	40	—	20	[illegible]	[illegible]	[illegible]

[illegible]

NOVEMBER 1991

SUN	MON	TUE	WED	THU	FRI	SAT
					1 P-F	2 F
3 F	4 F	5 F	6 F-P	7 P	8 P	9 P
10 P-F	11 F	12 F	13 F	14 F-P	15 F-P	16 F-P
17 F-P	18 F	19 F-G	20 G	21 G	22 G-F	23 F-P
24 P	25 P	26 P	27 P-F	28 F-P	29 P	30 P

RANDOM OUTPUT

David Cassidy N1GPH

State of the Shack

Since moving out on my own, I've had what could be called a "shack" in three separate locations. One was a corner of the bedroom in a tiny apartment in Hamden, Connecticut. The next was in a basement room in Weare, New Hampshire, and the latest (and best) is in a ground floor room in my home in Hillsboro, New Hampshire. With each location, the possibilities for my shack have become better and better—more room, more isolation from household and radio interference, better antenna possibilities, less chance of causing TVI. So, how come my shack always looks like a garage sale?

Actually, comparing my shack to a garage sale is doing a disservice to garage sales. My shack is usually much worse.

Since my shack also serves as my home office as well as my home recording studio (4 tracks of analog and 8 tracks of digital), I suppose I should cut myself a little stack. Still, I must be honest and admit that it's not the amount of equipment. If it were all arranged in an organized manner, it would all be usable AND neat. Most of the stuff in my shack is neither.

Desk #1 holds my basic HF and packet stations. Nothing fancy, just a modern HF transceiver, antenna tuner, an HT and 30 watt amp, multimode controller, computer and monitor, plus a telephone, microphones and other accessories. Since I test a lot of ham gear for *73*, I usually have at least one extra HF transceiver set up in a temporary position. This means that my Drake TR-4 must give up its place on desk #2 and is relegated to the floor next to desk #1 (behind the closet door, next to the spare microphone stands). Also on desk #2 you will find at least one 2 meter/440 MHz transceiver (but usually two), a couple of HTs and assorted batteries, chargers, etc. Moving around the room, you'll find the recording equipment—an electronic keyboard, and a stand for the rhythm composer (what they used to call drum machines before they became so complicated and realistic sounding) recording and processing gear.

All this stuff, when stacked up neatly, is not a problem. The problem is that it seems that everything in the room requires at least two strands of cord or wire to make it operate—one going in and one going out. The transceivers must each have an antenna and microphone. The recording gear must have microphones, as well as a patch cord in between every processor. The packet station and computer have more wire than some Southwestern cattle ranches. To this maze of cable we must add a power cord for each and every piece of gear. Of course, because there is SO much gear, I had to add a few AC terminal strips/surge suppressors, which are nothing more than the independent contractors of the cord world. They don't connect to anything. They're just cords for cords' sake.

Along with this prime shack real estate comes a nice, sizable closet for shack use only. This closet can be walked into. This closet has two rows of shelves lining three sides. This closet has its own separate AC circuit and light switch. This closet is bigger than some of the apartments I've lived in. This closet is entirely, one hundred percent, with not one cubic inch to spare—full. Full, full, full. Full to the very threshold of the closet door—a door which does not close because the fullness is too full and is starting to enter the room (which, as we've already established, is full).

I promised my wife that I wouldn't just throw my shack together haphazardly this time. When we moved into this house, I promised her I would leave the stuff set up on the desk until I could arrange the room into a permanent and pleasing arrangement. I have kept this promise. The room is still set up temporarily. The walls are bare of any posters, charts or maps. The closet is still full of boxes to be unpacked (boxes full of more wires and cords, I'm certain). Antenna wires enter through open windows. The 20 amp power supply is in the same exact spot it was placed on the day we moved in. The only difference is that it now has red and black wires snaking out from behind it.

I know my life would be a lot happier if I would take some time to organize my shack. The longer I wait the more difficult it is to begin, because a shack is not a static thing. It is a living, breathing, GROWING entity. It has a life of its own, and the longer you have it, the bigger it gets. A new piece of gear comes in and the box gets thrown on the floor (I'll store that box just as soon as I clean out the closet). A new boom microphone is installed. I'll run those cables neatly next weekend, but right now I'll just leave them where they fall. Look up an address and the *Callbook* gets a new home on top of the stack of other reference books I swore I'd return to the shelf. After all, it's only temporary.

After the "never put anything back where it came from" sickness I suffer from, the other affliction I must confess to having is the dreaded "never throw away a piece of paper" disease. Since I like to keep notes on just about everything, the amount of loose paper displayed in my shack at any one time would probably be a cause of some concern to the local fire marshal. I have pieces of paper with net frequencies (no net names, mind you—just the frequencies). I have pieces of paper with the settings of my antenna tuner for each band of operation and each antenna—even antennas that have been taken down and are currently living somewhere in my closet. I have pieces of paper listing items for sale, obtained from local swap nets and packet bulletin boards. I'm not looking for any new gear, you understand—I simply must write down any potential bargain. I have pieces of paper containing the orbital data of satellites that have long ago burned up in orbit. I have pieces of paper with telephone numbers—no names, just telephone numbers. I have pieces of paper containing directions to places I've never been to and have no intention of ever visiting. Paper grows on my desks and floor like a fungus. I've tried everything—spraying, washing with bleach, dehumidifiers—nothing works. Maybe there's something about RF frequencies that is conducive to yellow legal pad paper growth.

I must admit that there are some positive aspects to my shack's constant state of chaos. I can operate several bands and modes at once. I've often had 2 meter packet, HF RTTY, 440 repeaters and HF sideband all going at the same time. If the muse hits me, I can wade through the snake pit of cables to my 4-track tape recorder and within minutes record a potential hit song for posterity. I have faithfully kept every packing box from every piece of gear of any kind. If anything ever has to be shipped out for repair, I'm prepared (I've been a ham for 20 years and have only had to ship back one HT for repair, but you never know). With all cables and wires exposed, I can change configurations in an instant. Hiding the wires neatly behind the desks and along the baseboards would mean I'd only have to rip them up whenever I wanted to move things around. Since the bookcase is on the opposite side of the room from my operating position, it is more convenient to stack the books on my desk. After all, I'm sure that I'll need to check that WWII-era *ARRL Handbook* again in the near future. Why bother putting it back on the shelf?

Plus. . .since the bookshelf is now empty. . .I can bring in a few more books! 73

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DECEMBER 1991
ISSUE #375
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Cover design: David Cassidy
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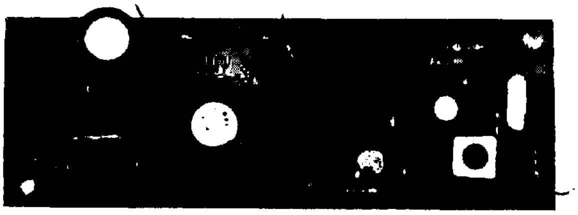
DEPARTMENTS

Due to space limitations, the 1991 Annual Index will appear in the January 1992 issue.

FEEDBACK... FEEDBACK!
You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to *73*.



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Audit Bureau of Circulations (ABC) membership applied for.

Contract: Help wanted—Elves with amateur licenses needed for 'round-the-world DXpedition on December 24th. Write to K. Kringle, Box 1, North Pole.

Number 1 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1

Aspen '92

Anybody who has to be told twice about the Aspen Ham Colloquium in order to get him to decide to go, probably shouldn't go anyway. We don't need any wishy-washy namby-pambies clogging up the works.

The ham business is in trouble and action is needed. Yes, I said ham business. Any of you commie fellow travelers who still believe that socialism is better than capitalism have your head so far up your. . . er. . . armpit, that you need some fresh air. Non-profit? That's the ticket to bureaucracy and lousy service.

As I pointed out last month, it's this non-profit baloney which has so badly screwed up our postal "service" and our educational "system." The sooner we take these public projects private, the sooner we'll start getting some productivity. Just look at the terrible mess our non-profit ARRL has made of our hobby! They destroyed the American ham industry 25 years ago, from the manufacturers down to most of our ham stores. Now they're non-profiting away in Newington while technology is squeezing us out of our frequencies. I'll take for-profit and the merciless marketplace every time for efficiency.

When we use the capitalist system we vote every day with our dollars. And this works for every range of products, from Rolex right on down to Timex. They both keep just as good time, one's just flashier than the other. Private schools can provide better educations than public for every economic level. Once we changed to public schools in the last century our literacy rate dropped and it's never come back up to what it was.

The 16th Annual Winter Ham Colloquium will be in Aspen February 1–8th. Gonna be there, skis and HT in hand? We'll save a chair at our table for you.

Doing Something

Not everyone is sitting on their. . . er. . . laurels. I see in *EDN* that Bob KØDYH is starting a science club in Wichita to stir kids' imaginations. Where are the experimenters? "They're all around us, just waiting for the opportunity to grow," says Bob.

He's lined up mentors to help the kids learn about aviation, electronics, amateur radio, computers, photography, astronomy, and so on. The local Lions Club will help finance National Science Fair projects.

Good idea. . . so how about getting something similar started in your area? Or perhaps as an activity of your ham club?

I remember, way before I discovered amateur radio, I had a great interest in science. I read everything I could get on rockets and space travel when I was around seven years old. I'd have loved a club like that. When I was eight I got a huge chemistry (Chemcraft) set for Christmas. My grandfather even built a workbench to go with it. I had a ball with the chemistry set and built my first radios on that same workbench when I was 14.

How about it? Our kids need all the encouragement they can get. Or would you rather see them dragging their untied shoelaces around the malls, with nothing much to do but cruise? If I ever develop any job openings for experienced cruisers I'll be able to fill them a thousand times over.

Radio Therapy

A chap in New Jersey has discovered a way to ease pains, such as those from arthritis, with low frequency audio modulated radio frequencies. Since he wants to put the device on the market, he's not given any details. He says it also works on horses with pulled tendons and other pains. I'll try to find out more.

Scientists have been gently zapping cats with 2m RF, modulated at the brain frequencies in the 3–15 Hz range. The field strengths used are on a par with what we normally experience when we use our HTs. Even at these low powers the results with the test group have been markedly different from the control group.

No, they have no inkling so far as to how brains demodulate the 2m energy or why the resulting low frequencies have such a powerful effect on the performance and reinforcement of behavioral patterns of the animals. These experiments are certainly going to get me to use remote mikes with my HTs from now on. . . particularly if any sub-audible tones are being used.

This work shows how much we have to learn about the brain. . . and about the effect of electromagnetic fields on cells. It's interesting that many of these experiments are well within the resources of the average amateur, the only stumbling block being a lack of curiosity.

Electricity has been gaining ground in medicine in recent years. It's used now to help the healing of bones and soft tissue, in many cases healing bones which have been broken for many years. Transcutaneous electrical nerve stimulation (TENS) is used to reduce chronic pain. Electroacupuncture is helping the treatment of heroin and cocaine addition. . . it even helps smoking withdrawal and jet lag, and improves learning and memory.

My thanks to Dr. Adey K6UI, a leading researcher in this field, and to the newsletter of the American Institute of Stress for the above data.

DXpeditioning

As I was reading a short item in Chod's *The DX Bulletin* about a group going to Albania, it got my juices up. Lordy, what fun that'd be! Gee, I wish some of these DXpedition groups would remember poor ol' Uncle Wayne when they're deciding who they want with 'em.

Well that's my reaction. . . what's yours? Do you get the urge when you read about DXpeditions? Do you say, "Dammit, that sure would be fun!"? Or has a defective gene or irresponsible parental upbringing grounded you? Or perhaps you feel family responsibilities have permanently clipped your wings?

I don't care how busy I am or how important work is, if I get invited on a really good DXpedition, I'll have my bags packed in minutes. Should I bring along my cute little ICOM 735? How about some antennas? What else do we need? My passport is at the ready!

No, I'm probably not the fastest operator in the world. . . though I think I am and am willing to tackle the pile-ups from the DX end with anyone who wants to challenge me. I'll work those piles, right on down to the mobiles and QRP, and I'll still rack up contacts faster than anybody else with my system. I'll even try not to get testy when the Goliath Big Gun DXers insist on not waiting their turn. Aha, but will they ever get a QSL? Heh, heh. Unk Wayne is merciless with bullies.

So this group is headed for Albania and monumental pile-ups. . . and I'm sitting in New Hampshire writing this damned editorial, watching the first hints of red in the sky over Crotched Mountain as the sun starts working its way up. My barefoot 735 is sitting at my elbow, waiting. . . patiently waiting, perhaps hoping to be packed away for use in some fascinating spot.

Sure, travel is expensive. Well, it isn't anywhere near as expensive as it seems if you do some planning. Like getting an airline credit card and racking up as many free miles as you can. I use it as much as possible for company expenses, so I've got enough free miles saved up to circle the earth a few times.

Clothes? Heck, there aren't any dress codes for most DXpeditions. Oh, you don't want to look like a homeless person. Some plain old Banana Republic stuff will do fine. That's what I wear most of the time anyway.

You're probably not going to be DXing from a country with a Hyatt hotel. . . unless you're heading to Sabah, where I recommend the Kinabalu Hyatt. Great spot to visit. . . particularly if you'd like to do some diving too. The diving there is almost beyond description in terms of excitement. And one more thing, you don't even have to bring a rig. . . the local hams couldn't be more friendly, so they'll like nothing more than to let you sit at their rigs and work about 10,000 Japanese for them . . . plus maybe 5,000 Indonesians. . . if you'll handle the QSLs!

My first DXpedition was back in 1958 when six of us went to Navassa. We first planned on Clipperton. I still have the FO8AS call I got for that trip. . . finally got to use it in 1966 when I visited Tahiti, where I used FO8AA's station.

I got the call KC4AF for Navassa and we had one heck of an adventure. I've got to tell you about that sometime. We went through a hurricane and almost crashed on a reef getting there. Then we came that close to getting killed when we stopped at Haiti. You'll love the part where I have to dive in shark-infested waters to retrieve some dropped antenna elements.

That's part of the excitement of DXpeditioning. You're going to rare spots and you don't know what's going to happen. Sure, it can be dangerous, but that's part of the excitement.

Other DXpeditions can be luxurious. . . like the time I operated for a couple of weeks from King Hussein's summer palace. It doesn't get any more luxurious than that. . . complete with a king for company on a ham-to-ham basis.

Of course the burning of the American Library in Amman the day before I got there and the stoning of our embassy made walking about downtown not particularly wise. Another American ham ignored the warnings and managed to get beaten up by a couple PLO soldiers. But then he was Jewish, took pictures of the soldiers, and his wife was wearing a miniskirt. . . three very big no-nos in Jordan at the time.

I can't understand why you haven't gone on a DXpedition yet. It's fun and

Continued on page 84

QRX . . .

EDITED BY LINDA RENEAU KA1UKM

Albania Success

The International Amateur Radio Union (IARU) team of operators/instructors returned in early October from a successful operation in Albania. The ZA1A team was given the honor of establishing amateur radio in Albania and training 12 Albanian students to carry that seed further. During the expedition over 71,000 contacts were made. Thanks to the ZA1A project, Albania is no longer a rare DX country and will continue to be active. On October 8, the ARRL DXCC desk approved the ZA1A operation for DXCC credit. The NCDXF is aiming for the shortest ever turnaround in QSLing for any major DXpedition. They started shipping out cards as of October 26. The QSL address is NCDXF, P.O. Box 1, Los Altos CA 94023. Please include two SAE/SASEs. TNX *Erkki "Eric" Heikkinen OH2BBF, Martti Laine OH2BH and Yaesu USA.*

Business on the Bands?

FCC Rule 97.113, "Prohibited Transmissions," could be changed to permit "personal business" communications, including ordering pizza by autopatch. At the recent ARRL National Convention held in Saginaw, Michigan, FCC Private Radio Bureau Chief Ralph Haller N4RH startled listeners with this proposal, which he says was in response to numerous requests from the ham community to broaden the range of amateur communications. The Commission indicated that it was open to the filing of a request for a rules change that would address certain aspects of quasi-commercial use of amateur radio spectra by hams. Among the possible changes would be: allowing hams to conduct personal and club business over amateur radio; increasing access to amateur radio for local government activities and nonprofit organizations; permitting greater latitude in the gathering and dissemination of news, even for the media, by hams through amateur radio; and permitting payments to educators who operate amateur radio stations for educational purposes. The proposal would also permit hams to retransmit other radio services, such as the Voice of America, WWV, and NOAA bulletins.

Says Haller, "As frequency managers, we feel overly bureaucratic when we have to tell you that you must not use your unused Amateur Service frequencies for non-amateur purposes. After all, the real anti-exploitation rules are those rooted in your respect for the principles for which your frequencies are made available to you, and by your good judgment." *[Unused Amateur Service frequencies?]* When traditional uses of the amateur bands are insufficient to "completely occupy all available amateur spectrum," amateurs should be allowed to use "inactive" frequencies for these almost-commercial operations. This would be on a secondary, noninterfering basis with all other amateur radio communications. These secondary communications would be limited to areas falling under FCC jurisdiction, and where international regulations do not take precedence. The question is: What are the implications of this proposal, and if such a proposal were accepted, how might it change amateur radio? TNX *W5YI Report, Vol. 13, Issue #20, Westlink Report, No. 611,* and others.

Museum Station W4BFB

On Saturday, November 2, the Amateur Radio Education Center at Discovery Place, Charlotte's Science Museum, North Carolina, opened its doors. Opening on the same day were an OMNIMAX Theatre and America's largest Spitz Space Voyager Planetarium.

Station W4BFB, under the direction of the Mecklenburg Amateur Radio Society, invites and encourages all licensed hams to use this fine equipment.

The Science Museums of Charlotte accept tax deductible contributions for the purchase of more radio equipment and station supplies. Contributions also enable them to conduct radio license classes. With a contribution of $100, your QSL card is permanently sealed in plastic and mounted on a wooden panel inside the station for all to see.

For more information, write Science Museums of Charlotte, Inc., 301 North Tryon Street, Charlotte NC 28202 or call (704) 372-6261.

Ham Arrested for Owning Ham Gear

Eric Dobrowansky KA2YKC has been indicted by a New Jersey grand jury on charges of having amateur radio gear in his car that can receive police dispatch channels, which violates New Jersey Statute A2A 124-4. The police channels are adjacent to the 2 meter band. Dobrowansky was arrested late last year by the Cranford police while trying to assist that department in its hunt for a jammer of its police radio communications. His mobile ICOM IC-901 transceiver receives on the frequencies of 136–174 MHz.

The indictment angered the New Jersey amateur radio community. New Jersey hams were already involved in a major political battle to overturn the 30-year-old law under which KA2YKC was charged. The replacement measure, New Jersey Assembly Bill A-3044, or the "Mendelsohn Law" after ARRL Hudson Division Director Stephen Mendelsohn WA2DHF who has been spearheading its passage, would make possession of mobile scanners a criminal offense only if the device was used in conjunction with the commission of a crime.

While hams in the community are deciding what to do, or have perhaps already engaged in doing some of the ideas they have thought of (picketing the P.D.? getting on "Inside Edition"? forming a motorcade equipped with banned gear and driving around town?), Eric Dobrowansky KA2YKC has refused a court plea bargain that would have permitted him to enter a no-contest plea. Instead, he has elected to demand a jury trial. He is represented by ARRL Volunteer Counsel John Norton N2IOB. If convicted, Dobrowansky faces up to a year in jail and several thousand dollars in fines, or both. TNX *Westlink Report, Number 610.*

Let's Talk Radio

A growing number of TVRO (satellite dish) listeners have been tuning in and discovering a very intriguing audio subcarrier. This audio show is called *Let's Talk Radio,* and operates every weeknight from 6 p.m. Eastern till past 2 a.m. (9 a.m. till 2 a.m. on weekends). It features live call-in discussions about amateur radio, TVRO, and shortwave listening, along with a wide array of regular talk show hosts covering just about any topic (usually between 9 p.m. and midnight). Operated by Jim Bass of Syracuse, New York, the listening audience covers most of North America! You can tune into the show by looking at Spacenet 3, channel 21 (S3-21). You'll probably see a scrambled picture, so just turn off or unhook your videocipher unit, tune into the 6.2 MHz audio subcarrier, and join in the fun.

In addition, Jim has an HF receiver at his home which he uses to uplink various amateur radio nets to the satellite subcarrier. Currently he uplinks the ATV net every Tuesday night at 9–10 p.m., various swap nets (usually between 8–9 p.m.), and the weekend TVRO HF net. Anyone who would like more information, or who would like Jim to uplink your net or special activity, should contact Jim Bass, c/o Let's Talk Radio, P.O. Box 254, Syracuse NY 13215. Or call him at (315) 673–3752.

Tropical Hamboree

Every ham is encouraged to bring a young nonham to the Youth Forum on Sunday, February 9, at the Tropical Hamboree in Miami. Carole Perry WB2MGP, famous teacher of amateur radio to young people and conductor of the Youth Forum, also needs **good speakers and presenters under 18 years of age.** Write Carole at P.O. Box 131646, Staten Island NY 10313-0006. (If necessary, you may call Carole at 718/983–1416.) For information on the Hamboree, write Chairman Evelyn Gauzens W4WYR, 2780 NW 3rd St., Miami FL 33125.

Number 3 on your Feedback card

LETTERS

From the Hamshack

Orville Gulseth W5PGG, Minnetonka MN I was thinking about sending a subscription to *73* to my grandson, who is nearly 13 years old and just getting started in ham radio. (This is the third generation of hams in the Gulseth family.) Then after I saw the picture of WK3N's QSL card on page 87 of the September 1991 issue of *73*, I decided not to. That spoiled an otherwise very good issue.

Orv, in a few months your grandson will discover girls all by himself and we'll get the subscription from him. You must have a great time censoring all his newspapers and magazines and keeping him away from the TV. Imagine what would happen if he ever saw Murphy Brown! . Wayne

W.E. Beckman WA9JIE, Buffalo IL I have a problem I haven't been able to resolve and am now requesting the help of the amateur fraternity. It's the computerized equipment in my Lincoln Town car that puts out millions of harmonics, and makes a royal mess on my 10 meter HR-2600 transceiver. I haven't dared try my Icom 730.

Remedial steps included good grounding of the equipment to chassis, running RG-8/U coax directly from the car battery into the transceiver with ground strap to coax shield near both the battery and rig. No success. I have put ferrite beads on all power and speaker leads inside the rig. Still no success. (Ran out of beads and could not do the mike leads.)

With the computer chip becoming more and more prevalent in our society, more problems are going to arise. Hopefully some of the hams out there have found a tried and true way of getting rid of all this chirping in their mobile rigs and would like to pass that information on. I'd hate to have to build a Faraday cage around the darn thing; I'm hoping to find an easier solution through my fellow amateurs.

Wolfie, my Toyota Previa van is marvelously silent and handles better than the Lincoln. That's one way to cure all that hash. . . . Wayne

Mark Cronenwett KA7ULD/6, Santa Clara CA After being inactive for several years, I am very happy to see that you are still around. Your editorials are the very first part that I read then and now. I can see that things must not have changed much.

Your editorial in the September issue was great. The part about clubs was excellent. I remember when I joined the local club In Montana. At 17, I was the youngest member; the next closest was about to retire. I didn't like it much after a while.

I have no problem with heights and climbing towers, and I am also very helpful by nature. So I found myself doing a lot of tower work for all of the members of the club who suddenly found they couldn't do it for themselves.

Now I am debating about joining a club or not. I have noticed on the local repeaters that no one will talk to you if you don't belong to the club or group. I originally stopped because I was getting harassed for being a pirate station. Fortunately, that hasn't started again.

Mark, what did you get in return for climbing towers for the geriatrics, a hearty handshake? If they make it worthwhile in some way, no problem. You don't owe 'em free work. Same thing with a club. . . if it's fun, then join. It's that simple. If it isn't fun, forget 'em. And if they don't want you on their repeater, put your own on, and don't let 'em use it. No, better, send me their calls and I'll print 'em in my new Ham Hall of Shame. . . . Wayne.

Kevin KD4CNH, Key West FL I can't begin to tell you how much I enjoy your editorial in *73*. I think you speak for the majority of us new and future hams. I love the part about the fogies. It reminds me of the "I had to walk five miles to school, uphill both ways, always three feet of snow on the ground," saying. I'm an avionics technician for the Navy, and agree with you when you say most don't know what they are talking about. I just believe if you can't say good things about a person, don't say anything. If you're ever talking Florida, give me a call on 10 meters. The 2510 is always scanning! And I love to talk; but make sure you have some time to spare!

Kev, baby, if you don't have anything good to say about a person, write an editorial. . . Wayne

Robert Dickson N4UBK Mr. Green, if it was not for your efforts, I would have been "out of there" a long time ago. Did you know that *73 Magazine* is the only ham publication in the military bookstore on Ramstein AFB, Germany? I read only *73*, beam *[?]* and *Funk Amateur*, which are excellent mags, but if I had to pick one, it would be your *73*. Keep up the hard work.

Don Norman AF8B, Elyria OH The no-code Technician license is changing amateur radio rapidly. Although a recent *QST* analysis says that 90% of new exams are for no-code, it doesn't fit my experience. Seems more like 40% of total exams to me.

Almost all no-code Techs that I have met are working on the code, and I have had two pass their 13 wpm in VE sessions I've worked.

If the hobby is to grow, we need more VE sessions. No matter where a session is held, candidates appear. I have assisted in three sessions in Gilmer County, West Virginia, and no session has had less than 10 candidates.

I suggest *73* magazine do some material on 6 meters. This was a lot of fun in the late fifties. Suppose a 6 meter rig like the Uniden 2510/2600 were available. Seems like a natural for the no-code people.

Norm, ol' boy, I've been hoping that the last ham on 6m would write something for Radio Fun *so we'd get more activity there. It's a wonderful band. . . . Wayne*

Robert A. Willingham N5UYA, Tularosa NM You *[Wayne]* inquired in your note how I had been received on the air. This is hard to quantify. I can say that nobody has been openly hostile to me; I've head a number of derogatory remarks about us "codeless Techs" voiced on the air among some of the "old-timers." They don't think we can operate correctly. Believe me: All the nonsense and bad procedure isn't just on 20 meters! I don't think most of these know-it-alls could pass a test on the FCC regulations, much less Morse code! All of my QSOs have been on 2 meters so far, and I'd say the "friendly vs. unfriendly" has been about 50-50. As I say, nobody has been openly hostile, but I've been given the brush-off more than once. I find that the other "codeless Techs" are always eager to find a friendly voice. I might add that while this part of the country is sparsely populated, we've got a lot of 2 meter repeaters available for use on the surrounding mountain tops and a couple of linked systems, one that stretches from Texas to California. The result is that I hear a surprising amount of activity in the "scan" mode.

As far as reception in other areas, that hasn't been extremely warm either. I don't have any close friends among the local amateur community, but a lot of them know me on sight and now know I am licensed. Nobody has invited me to a meeting of the local club. I went to the local hamfest a few weeks ago and mostly all who would talk to me were selling something. I did run into a guy I took the examination with and he seemed to be glad to have someone to hold a conversation with.

There was one notable exception. I walked up to the ARRL booth and introduced myself to the section manager, Joe Knight W5PDY. He extended to me what I thought was a heartfelt welcome to amateur radio. (I've heard Joe on the air a lot, on 2 meters, and running the net on HF, and I think he is a genuinely nice guy.) I guess the ARRL isn't all bad, but we knew that anyway.

In general, I think a lot of these old-timers don't realize the value to the hobby a lot of us "codeless Techs" could be. Just think of the repeaters, satellites, and other high overhead goodies our money could help finance. Your magazine might become as thick as the Japanese ham magazine you mentioned in one of your editorials. To give you a little bit of my technical background: I've operated my own two-way radio shop, ran a telephone construction company, consulted for AT&T Long Lines and Mountain Bell in the common carrier microwave area. I engineered and built a lot of the private and industrial microwave systems in the southwest. I've done a lot of broadcast engineering work, including building an FM station from the ground up in El Paso, Texas. I've had, along with all this, extensive experience in the data communications field.

No, not everybody has had the background that I have had, but just think of the computer hobbyists out there who could add their knowledge to the pool.

As far as operating on the ham bands, right now I'm confined to 2 meters. My next step is to get involved with packet. I've got an IBM compatible computer already, so all I need is a TNC. I don't know about ATV; I don't have anything worth looking at, and nobody would want to look at me! I would like to explore the microwave region and use the amateur satellites, having had a lot of experience in those areas. I've got mixed feelings about trying HF. Look at the people you have to associate with down there! I'm glad we of the sub-human species have people like you out there beating the drum for us.

Ed Libera, Jr., WT1W, Palmer MA I have been licensed for one year now, having attained the Extra class license in just under seven months.

I read *73* every month, and I find that between the articles and columns, spiced with just enough advertisements, your magazine is a very good buy for $2.95. I don't want to subscribe, however, because I like to visit the YL who runs the local newsstand.

Your editorials, I find, do illustrate some of the nonsense that I have already observed in my new-found hobby. It's an ugly thing, the fact that some hams have been operating for so many years in the same modes, on the same bands, talking to the same people about the same things. Just listen to 75 meters AM, you'll find some don't even acknowledge the existence of SSB. Then you have the politicians, schizophrenics, drunks and dopers. Why does such an enjoyable hobby attract such weirdos?

I know people who spend all their air time on either 2 meter packet or windbag repeater rag-chewing, always talking about the same things. I get sick of being told that if I buy UHF and microwave equipment I won't have anyone to talk to. Then you get these guys who hear new operators on local repeaters and yell at them rather than trying to coach them.

I have been nominated for vice president of our local club, and will probably be elected. All the older members want someone younger (I'm 33) to have a place in club management. I am sworn to get new members and educate new hams, and to get these guys to talking about things besides "my dog's cataract operation."

Kathleen Smith VE3WKW, London, Ontario I look forward to getting your magazine every month at the newsstand. I love your editorials. I find that there is a general lack of enthusiasm with our local hams when it comes to newcomers or interested prospects, so you are correct. Not much of a surprise!

I am a newcomer to the radio hobby, but it seems to me that with an army of retired hams locally, there could be some effort to push our hobby a bit and lend a hand to newcomers.

At my radio class there were only two used rigs for sale, and no accessories at all. No dealers showed up to show off new equipment or even drop off catalogs. I think that a list of used equipment could have been compiled from the local repeater or from the local ham club.

I expected a visit from the president of the local radio club to round up new members, but this opportunity was missed as well. I must admit that some members of the 2 meter club showed up and were well received, so someone is doing some thinking.

One suggestion I would make is that amateur radio students could be paired with older, more experienced hams to help them find and get their stations running. Not to mention a chance to pass on all that knowledge before it is lost to the Silent Key Patrol!

I am temporarily inactive due to an illness and financial setback that forced me to liquidate my station, but as soon as I am able, I will be back on the air. The questions still stand, though: What kind of old rig is dependable, who do I buy it from, and how do I keep it running? Better yet, who will take the time to explain?

The Simple TX TX

The perfect companion for the SupeRX receiver!

by Bruce O. Williams WA6IVC

Ever since I introduced the Simple SupeRX (see the April 1991 issue of *73*), I meet QRPers looking for a companion transmitter at every hamfest I attend. The transmitter must have 2-3 watts output, provide reasonable performance and cost, and be suitable for portable or backpacking use with the SupeRX. It must also be able to operate on any band from 80 to 20 meters. And now it exists—the Simple Texas Transmitter (TX TX). It produces 1.5-2.5 watts on any one of four bands, is simple to build, and can be put on the air in about two hours.

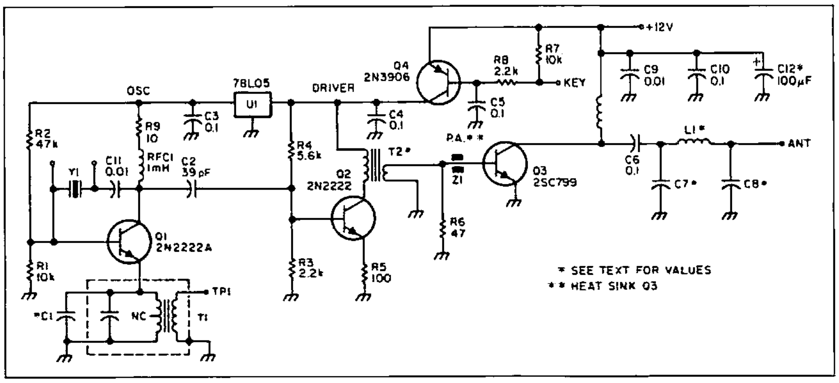

Figure 1. Schematic for the Simple TX TX.

After developing the Simple TX TX, I have a real sense of accomplishment. It only oscillates where it should, and it's not a particularly exotic design. It uses a basic oscillator/driver/amplifier scheme. There are a couple of improvements over the classic circuits, but by and large, it is a perfectly straightforward application of several proven circuits. Refer to Figure 1 for the schematic. Q1 is a bipolar-transistor Pierce crystal oscillator. A tuned output is desirable in a crystal oscillator to maximize power output and reduce harmonics. However, in the Simple TX TX, unlike most circuits, the resonant circuit, T1, is in the emitter of the transistor. This provides the necessary stability and purity of the signal I wanted.

I tried the microminiature 10.7 MHz IF transformer in the collector circuit initially, and attempted to take the oscillator output from the secondary of the transformer, but discovered that the output of the oscillator was too low, requiring an additional stage to drive the final amplifier. With the resonant circuit in the emitter, the output of the oscillator, taken at the collector, is about 4 Vpp, and it does not exhibit the distorted sine wave that many crystal oscillators do.

The oscillator collector voltage is regulated at 5 volts by U1, a subminiature 78L05 voltage regulator rated at 100 mA. Since the collector current of Q1 is only about 10 mA, there is little stress on the regulator. Keying is accomplished by controlling the 12 volt input to the regulator via Q4. This arrangement creates a smooth keying characteristic, without clicks or other problems.

Q2 is a conventional buffer/driver. The 2N2222A is capable of driving the final amplifier to about 1.5 watts with 12.0 volts, and over 2.0 watts with a 13.5 volt supply. Q2 is keyed with the oscillator by Q4. T2 is a wideband balun transformer that drives a conventional class C final amplifier, Q3. Because of the nearly pure sine wave output of the oscillator, the output from the PA is clean and free from distortion.

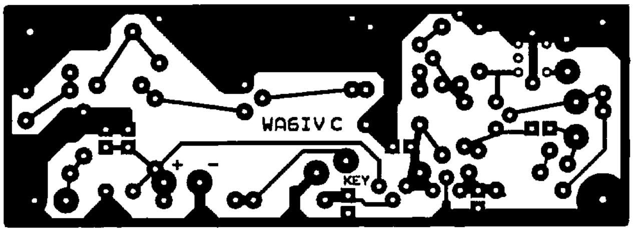

Figure 2. The PCB foil pattern.

The simple output filter (L1, C7 and C8) attenuates harmonics, but provides no impedance matching. It is taken directly from the ARRL's *Solid State Design*, a book by Wes Hayward W7ZOI and Doug DeMaw W1FB (1986). Because the output power is less than 5 watts, this filter provides sufficient filtering to meet FCC spectral purity requirements.

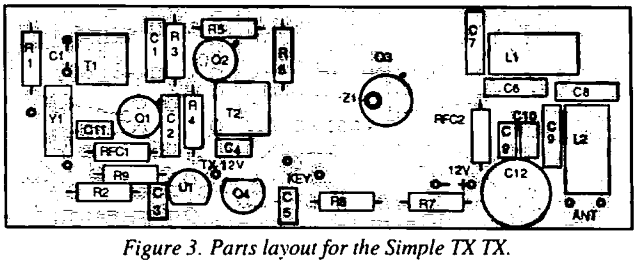

Figure 3. Parts layout for the Simple TX TX.

There are several good bipolar amplifiers available that could be used for Q3. The 2SC799 is

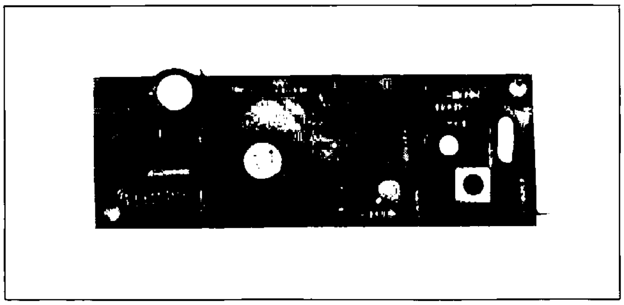
Photo. The simple TX TX.

T2 Values

Band	Primary	Secondary
80m	5 T No. 28 enam.	1 T No. 24 enam.
40m	5 T No. 28 enam.	1 T No. 24 enam.
30m	4 T No. 28 enam.	1 T No. 24 enam.
20m	3 T No. 28 enam.	1 T No. 24 enam.

Output Filter Values

Band	C7, C8	L1
80m	750 pF	21 T No. 24 on T-50-2
40m	470 pF	14 T No. 24 on T-50-2
30m	300 pF	12 T No. 24 on T-50-2
20m	210 pF	12 T No. 22 on T-50-6

readily available at low cost. It was commonly used as an output amplifier in CB rigs, and is capable of up to about 4 watts. Of course, the 2N3866, 2N4895, RCA 4013, or any of several other TO-5 configured transistors can be used. The MRF 472 and MRF 476 are also usable with a slight change in pinout.

The Simple TX TX design is very forgiving. You can substitute parts of different values for almost any of the components shown. The only critical parts are the 10.7 MHz transformer, T1, and the output filter components. I tried several different values for RFC1 and RFC2, and the effect on performance was minimal.

Construction

I built the Simple TX TX prototypes using printed stripboard (see the table for sources of parts). This product is easy to use, and not expensive. So-called "ugly construction," or what Zack Lau KH6CP/1 now calls "ground plane" construction, is another option. I personally have never had much luck with this approach, but I know of many home-brewers who do very well using this technique. However, a printed circuit board is available at a reasonable price (see the table). Figure 2 shows the etching pattern for the circuit board, and Figure 3 shows component placement. You can get a complete circuit board kit from MXM Industries. I recommend using the available printed circuit board, since it speeds construction and makes it difficult to "garf" up the circuit.

Start your construction by installing the power supply capacitors and keying circuit components, and the 5 volt regulator, U1. Don't make the mistake of attempting to complete the entire transmitter before testing the individual circuits. Build one stage and check it out before going to the next. Troubleshooting the entire transmitter will drive you nuts, and there is a strong likelihood that you will damage some of the components in the process! After assembling the regulator and keying circuit, make sure that the output of U1 is approximately 5 volts (typically 5.02 volts), and that the keying circuit operates properly. Only after this crucial step should you continue.

Install the components of the oscillator (R1, R2, R8, T1, C1, RFC1, Q1, C2) and verify that the oscillator is operational before continuing to the buffer/driver, Q2. Tune T1 for the best sounding signal, not necessarily the signal with the most output. Check that when the oscillator is keyed there are no key clicks or other anomalies during keying. You can monitor the output of the oscillator on a ham band or general coverage receiver. If you have a frequency counter or oscilloscope, a small piece of component lead can be soldered into the board at TP1 to allow confirmation of the proper signal. Don't be surprised if the frequency of oscillation is a little above the frequency indicated on the crystal (1–2 kHz). It's easy to tune the output of the oscillator to the frequency you desire later.

Extra Adjustment for 20 Meters

T1 is a microminiature (7mm) 10.7 MHz IF transformer. To make the transformer resonant on the particular band of interest, a padding capacitor must be added across the 3-pin primary. Different values for capacitor C1 for operation on the 80, 40, 30, and 20 meter bands, respectively, is given in the parts list.

Although the value for the padding capacitor is shown as 27 pF for 20 meter operation, some modification to T1 is also required. There is a small ceramic capacitor mounted in the base of the transformer. This capacitor must be *carefully* removed before you install the transformer on the circuit board.

Carefully break the capacitor in half, using a very small, sharp X-ACTO® knife, and pull the two halves out. Do not try to pull the halves from the transformer base. First, carefully cut the leads connected to the halves, then remove the halves.

Check continuity between the two outboard pins on the 3-pin side of the transformer. If there is no continuity, the transformer must be replaced. With this capacitor removed, T1 will be resonant at 20 meters with the addition of the 27 pF capacitor as C1.

The value of 39 pF for C2 limits the output of the Simple TX TX to about 1.5 watts with a 12 volt supply. If you wish to increase or decrease the output, some experimentation with C2 will be required. I found that if the value of C2 is as high as 100 pF, both Q2 and the output transistor will exhibit extreme heating, and shortly destruct! I found that the usable upper-limit value is about 51 pF.

Winding T2

T2 is a broadband transformer wound on a

Parts List

C1	20m, 27 pF; 30m, 18 pF; 40m, 51 pF; 80m, 330 pF	silver mica or polystyrene
C2	39 pF	silver mica or polystyrene
C3,4,5,10	0.1 μF, 50V	monolithic
C6	0.1 μF, 200V	monolithic
C7,8	470 pF	silver mica
C9,11	0.01 μF, 50V	monolithic
C12	100 μF, 35V	electrolytic
D1	36V zener diode	1N4754 or equi.
Q1,2	2N2222A	
Q3	2SC799 or equi.	
Q4	2N3906	
R1,7	10k, 1/4W	carbon
R2	47k, 1/4W	carbon
R3,8	2.2k, 1/4W	carbon
R4	5.6k, 1/4W	carbon
R5	100 ohm, 1/4W	carbon
R6	47 ohm, 1/4W	carbon
R9	10 ohm, 1/4W	carbon
RFC1	1 mH	RF choke
RFC2	47 μH	RF choke
T1	10.7 MHz microminiature IF transformer	Mouser 42IF222 or 42IF223
T2	wideband balun core	BN-43-2402
U1	78L05, 5V	regulator
Y1	HC-18 crystal, 32 pF parallel	select for frequency
Z1	FB-43-201	ferrite bead

Printed stripboard may be ordered from Dick Smith Electronics/American Electronics, P.O. Box 468, Greenwood IN 46142. (800) 872–1373.

Transformers are available from Mouser Electronics, 2401 Hwy. 287 North, Mansfield TX 76063. Tel. (817) 483–4422; (800) 346–6873.

For transistors and balun cores, you may contact Danny Stevig KA7QJY, P.O. Box 7970, Jackson WY 83001. Tel. (307) 739–1634, evenings.

A drilled and plated circuit board is available from FAR Circuits (N9ATW), 18N640 Field Court, Dundee IL 60118. Price $4.50 plus $1.50 S&H.

You may also obtain a complete circuit board kit, which includes all board-mounted components and a crystal on the QRP calling frequency for the selected band, from the author at MXM Industries, Rt. 1 Box 156C, Smithville TX 78957. Tel. (512) 237–3906. Price for the complete kit with crystal is $32.95 plus $4.00 S&H. Texas residents add sales tax.

A complete transmitter/receiver kit on a single board (uses the SupeRX receiver) is available for $79.95 + $4 shipping.

BN-43-2402 binocular balun core. I start winding T2 by putting the secondary 1-turn winding on first—1 turn of #24 enameled wire for operation on the 80, 40, 30, and 20 meter bands—then I wind the primary over the secondary.

The turns ratio for the primary winding varies with the particular band. For 80 and 40 meters, it's 5 turns of #28 enameled wire; for 30 meters, it's 4 turns of #28 enameled wire; and for 20 meters, it's 3 turns of #28 enameled wire.

The primary leads should come out of one end of the core, and the secondary leads out of the other end of the core. The balun core is extremely small, and the holes through the core are also small. If you have to use larger size wire, you may have problems getting all the turns on. You can use a larger balun core, of course, but some experimentation with turns and turn-ratios will be required. If you don't have a binocular type of core, a broadband toroidal transformer can be substituted. *Solid State Design* gives information for using toroidal cores as broadband transformers.

Output Filter

The final power amplifier, Q3, is a straightforward configuration which you may recognize as about standard for most QRP transmitters. The value of RFC2 is not very critical. I have tried values from 15 µH to 1 mH with little effect on performance. I found that the 1 mH value reduces the output a little, just because of the additional resistance of the winding in the higher value. Values from 25 to 100 µH will work fine. D1 is a 36 volt zener diode that protects Q3 from damage in the event an antenna is not connected when the transmitter is keyed.

Testing and Operation

If you have followed my suggestions about assembling each stage separately, by the time you finish construction, the transmitter will be ready to use. A few preliminary tests are a good idea, however. NEVER test the transmitter without a dummy load (of at least a 5 watt rating). If you don't have a suitable dummy load, you can construct one by placing three 150 ohm, 2 watt resistors in parallel, or by using any number of combinations. Although I have a 10–1000 watt dummy load, I generally use a small, calibrated SWR/wattmeter with a home-built dummy load. I find that my commercial dummy load/wattmeter is poorly calibrated at low power levels, showing less than a watt when the actual power is over 1 watt. One sure way to get a good estimate of output power is with an oscilloscope.

It is essential, even at low power levels, to use a heat sink on the final amplifier. In fact, it may be a good idea to put a heat sink on Q2, since it does carry a heavy burden in this design. Although during tune-up the final amplifier may seem to be running cool, when it is mounted in a cabinet, the circulation of the cooling air may be impaired. In the same vein, be sure to install a ferrite bead, Z1, on the base lead of the final amplifier.

It is possible to VXO the crystal a little by placing a capacitance across it. Don't expect too much of a shift, however. Maybe just 2–3 kHz. Remember that the tuning capacitor must be isolated from ground. I use a DPDT switch with a center OFF position, and connect the two center connections across the crystal. In the center OFF position, no capacitance appears across the crystal, and the frequency will be whatever the crystal generates. I placed two capacitors across the other two poles, so that if the switch is in one position, that capacitor controls the frequency, and if it's in the other position, the second capacitor controls the frequency. If you can't get the frequency where you want it with a fixed capacitor, there is room on the switch to mount a small variable capacitor to fine-tune it.

Good luck with your Simple TX TX! The project is so simple that you should not experience any major difficulties. If the darned thing doesn't operate right off, check your wiring for solder bridges, and see that the components are in the right place. With the Simple SupeRX, no problems have been reported to me apart from two isolated part failures not the fault of the design. If you think you have a problem that I might be able to help you with, or if you just want to talk about it, please do not hesitate to write or even call. ■

You may contact Bruce O. Williams WA6IVC at MXM Industries, Rt. 1 Box 156C, Smithville TX 78957. Please enclose an SASE.

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73 Review

by Rick Littlefield K1BQT

The Ramsey 2 Meter Transceiver Kit

Build your own high-quality FM rig the easy way.

Ramsey Electronics
793 Canning Parkway
Victor NY 14564
(718) 924-4560
Price Class: FTR-146, $150; FTR-C (cabinet), $25; add $10 S&H, plus $4.50 for COD.

When Ramsey Electronics first advertised the FTR-146 2 meter transceiver kit, the promise of a synthesized VHF radio for $149 was just too attractive to pass up. My only fear was that a project this inexpensive might be difficult to construct—or not work very well. Fortunately, these fears proved unfounded.

Features

The FTR-146 is a six-channel diode-programmable PLL-synthesized FM transceiver, covering 144.000 to 147.995 MHz. "Diode-programmable synthesis" means that you select six of your favorite operating frequencies and program them into the radio when you build it. Programming is done by installing diodes in a binary matrix, a procedure that is much easier than it sounds. Transmit offsets for +600 kHz, −600 kHz, and simplex are also programmed in by installing diodes. Ramsey conveniently provides a 12-position switch with the kit, so you can add up to six additional channels by expanding upon their diode matrix.

FTR-146 RF output is rated at 4–6 watts, which is plenty of signal for base or close-in mobile operation. Since the radio draws only 1.5 amps on transmit, nearly any inexpensive CB-type supply will provide enough power.

Although amenities like a signal strength meter, microphone, and built-in speaker aren't provided with the FTR-146 kit, it does include attractive "packet-ready" features other radios may not have—like PIN-diode T/R switching and a DIN-type TNC jack on the rear panel. An on-board jumper selects squelched speaker-level audio or unsquelched discriminator-level audio for your TNC. For an additional $24.95, Ramsey offers an attractive 9″ x 6″ x 1.5″ cabinet with silk-screened front and rear panels, and matching knobs. I found plenty of room inside this enclosure to install a home-brew channel expansion board and a 3″ speaker.

Constructing the Kit

With any kit, the dividing line between success and frustration usually depends on two key factors: the integrity of the circuit board, and the clarity of the instructions. A poorly designed board or a confusing manual can turn even the simplest kit into a nightmare Happily, I found the FTR-146's CAD-designed two-sided PC board an absolute pleasure to construct. Part locations are silk-screened on the component side, and there's plenty of space for everything to fit. You won't need the dexterity of a brain surgeon to make it look professional. The same CAD program that generated the board layout was used to produce striking 11″ x 17″ multi-colored parts placement and schematic diagrams for the manual. Credit goes to project designer Tom Hodge WA2YTM for some fine computer work.

In a similar vein, I found the kit's documentation, written by Dan Onley K4ZRA, to be equally impressive. The manual has over 100 pages of information and diagrams to guide you through construction, complete with check-listed steps, mini-schematics, and parts placement figures for every stage. Even the parts list is cross-referenced to the installation steps in the manual! The instructions are not only detailed, they're educational as well. By the time I completed the project I had learned a great deal about how synthesized transceivers work.

For the most part, you won't need special tools to complete this project. However, if you make a mistake, you may need a vacuum-type desoldering tool (or a roll of Solderwick™) to remove parts from the radio's double-sided, plated-through, PC board. Radio Shack's desoldering iron (#64-2060) is inexpensive at $8.49, and does this job well. Also, tune-up requires nonmetallic tuning wands, including one with an insulated metal tip like the GC-8608 (Radio Shack Tuning Wand Set #64-2230). Finally, some of the air-wound inductors are formed on a 3/8-inch 18-TPI bolt. If you don't have one on hand, this could mean an unscheduled trip to the hardware store.

Improvements

I really enjoyed building the radio. But, before I'm accused of working for Ramsey's ad department, I'll confess to at least ONE aspect of the kit that I don't like. The solid-copper bell wire supplied for point-to-point wiring of controls and switches was hard to handle—and easy to break. I threw it away and made a color-coded harness from flexible stranded wire.

More significantly, I had to solve a couple of technical snags to get my rig on the air. Initially, the radio's squelch circuit wouldn't function properly, due to a defective IC. Ramsey helped me find the problem and promptly mailed a new chip.

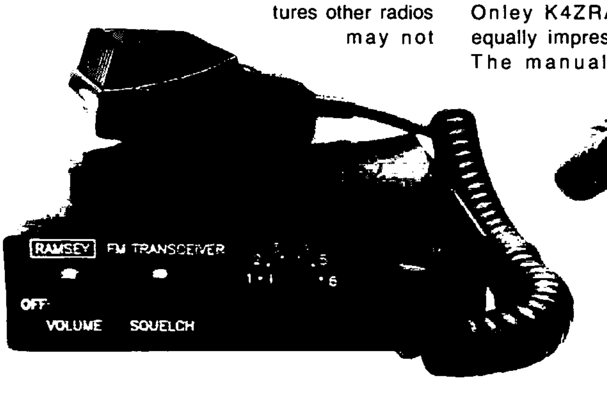

Photo A. Completed FTR-146, front panel.

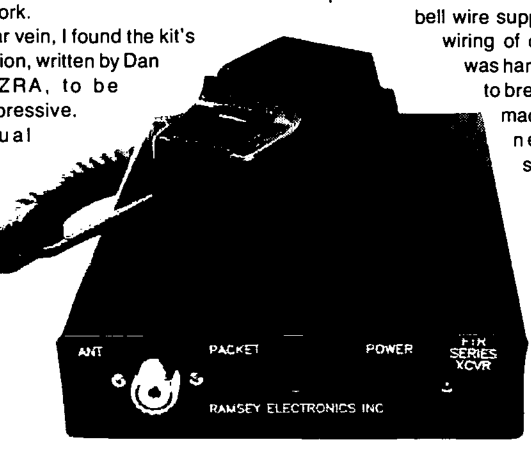

Photo B. Completed FTR-146, rear panel.

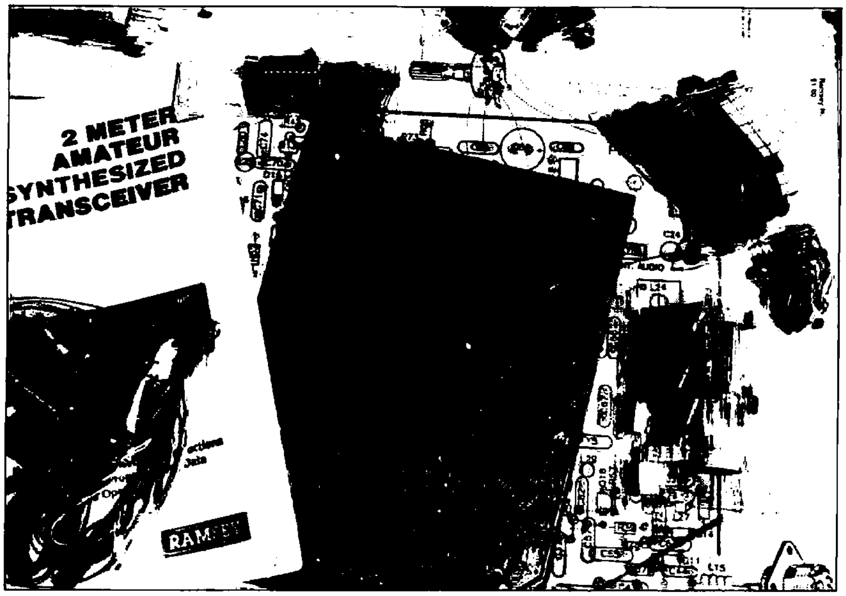

Photo C. The kit comes with a high-quality PC board, all components and excellent documentation.

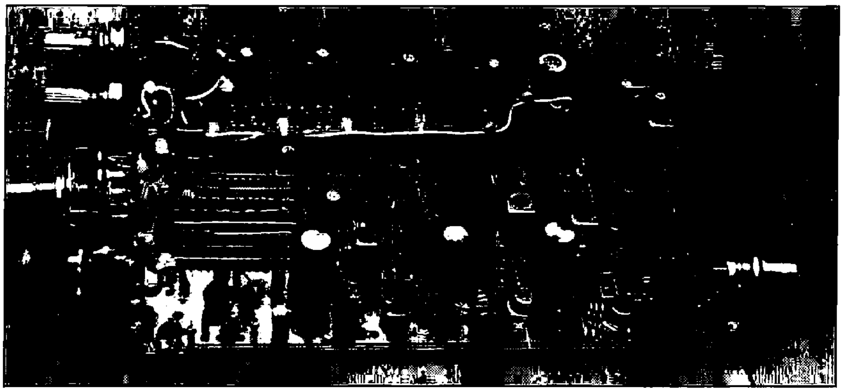

Photo D. The assembled FTR-146 transceiver board.

The second snag was a bit more complex. The radio's synthesizer IC tunes in 10 kHz steps. When a +5 kHz frequency change is needed for 15 kHz channel spacing, the loading on each mixer oscillator crystal is switched by diodes to "pull" that oscillator in frequency (recall the +5 kHz switch on your old synthesized HT). Unfortunately, I couldn't make two of the four oscillators in my radio pull far enough to hit both frequencies. I traced the problem to out-of-tolerance crystals. Once again, Ramsey helped me diagnose the problem, and promptly shipped the items I needed.

Getting on the Air

Aside from the crystal problem, alignment was straightforward. You'll need a frequency counter to set each oscillator on frequency, and an RF power meter to peak the transmitter. You'll also need a weak signal source to align the receiver. Lacking an expensive FM service generator, I terminated the antenna jack with a 47 ohm resistor and used a short scrap of wire to pick up a local repeater. Any signal weak enough to produce audible background noise will suffice.

During construction, you'll wind many of the radio's air-wound inductors by hand—a somewhat imprecise science. During tune-up, you may need to "tweak" some of these by compressing or stretching the windings (tweaking may be needed to bring a coil's associated trimmer capacitor in-range, or to optimize a circuit using a fixed capacitor). Once aligned, my radio delivered 4.5 watts into a 50 ohm load and approximated the receiver sensitivity of my ICOM HT. I later measured receiver sensitivity at a respectable 0.4 µV on an FM service monitor.

The FTR-146 microphone circuit was designed to work with an ICOM-type speaker mike, and employs "load-sensing" to activate the transmitter (there's no separate PTT line). If you opt to use a replacement-type mobile mike, you'll need to wire the PTT switch in series with the mike cartridge in order to key the radio. When I first tested my microphone, I got reports of a loud hum on the audio. I quickly discovered the cause to be stray RF pickup—a consequence of running the rig without a case into a rubber duck antenna. Connecting an external antenna cured the hum.

There are as many ways to package the FTR-146 as there are ways to use it. I keep mine next to our telephone, serving as base station for our "multi-ham" household. For this task, I installed a three-inch speaker in the Ramsey cabinet. This provides plenty of volume to hear calls while you're in another part of the house. More extensive customizing is possible—including sophisticated channel switching schemes, and even a digital display. Toward this end, manual writer Dan Onley has established a user's group and newsletter for FTR builders in order to share customizing schemes and circuit upgrades.

The Bottom Line

The Ramsey FTR-146 kit is a fine value from several standpoints. First, it's instructional. After building it I find synthesized radios less mysterious, and I'm more confident when tackling repairs on other radios.

Second, the FTR-146 is the right tool for the job. I don't really *NEED* a 50-watt radio with 100-channel scanning to hit the local repeater. The FTR-146 does this flawlessly, and people say that the Ramsey transmitter audio sounds superior to my other rigs!

Finally, for the serious packeteer, the FTR-146 may be a sensible radio to dedicate to online data communication. Hook it onto your TNC or modem and save your other rig for voice contacts.

Evolution

By the time you read this review, an enhanced version of the FTR-146 (the FX-146) will be available for $169. According to Ramsey designer Tom Hodge, this FM transceiver is now on the bench and headed for production soon. This new radio uses a more sophisticated synthesizer chip which expands receiver coverage to 20 MHz, provides a programmable offset, and facilitates producing 220 and 440 MHz versions of the radio. The new synthesizer also provides 5 kHz steps, eliminating the need to shift mixer frequencies. Other changes include a simplified receiver circuit using a more advanced IC. According to Hodge, receiver changes will provide tighter IF filtering, improved image rejection, an RSSI meter output, and enough extra board space to include a 12-channel diode matrix.

OK, so you are nervous around hot soldering irons and you have fat fingers. Should you tackle one of these kits? I say YES! Through the FTR-146, Ramsey Electronics has clearly demonstrated the ability to engineer and produce a good radio that's easy to build. And, they've shown that they can support it with first-class documentation. If my experience with the FTR-146 is any indicator, construction of the FX-146 kit should be a snap as well! I like my radio a lot, and I suspect that Ramsey transceivers are going to be with us for a long time to come. 73

Contact Rick Littlefield K1BQT at 109A McDaniel Shore Drive, Barrington NH 03825.

73 Review

by Dick Goodman WA3USG

The BayCom Packet System

Run packet without a TNC.

A & A Engineering
2521 W. LaPalma #K
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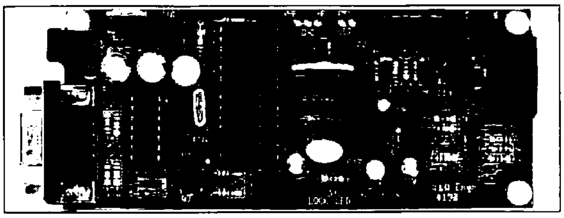


The A & A Engineering modem for the BayCom packet program.

Over the course of the last seven years packet radio has developed into amateur radio's fastest growing mode. The computer hackers love it, some operators find it useful for obtaining the latest information on a variety of subjects from ham radio to amateur astronomy, and other operators find that packet is not their "cup of tea." One thing stands incontestable, however: Packet has become prevalent in virtually all aspects of our hobby. Visit any reasonably large city, tune around 144.91–145.09 MHz, and the sound of various packet networks will greet you. Tune the HF bands near the domain of what used to be our primary digital mode (RTTY), and again the sound of 300 baud packet bursts will be heard. Virtually all of the new amateur satellites use packet as the communications medium. Most importantly, packet has given the amateur community visibility and recognition by advancing the state of the art in digital communications.

One of the main reasons for packet radio's skyrocketing popularity is its ease of implementation. Only a few years ago getting on packet meant building a terminal node controller (TNC) from a kit and interfacing it to one of the many then nonstandard computers. To those with computer expertise, this was a challenge that was eagerly anticipated. To others with a curiosity about this new mode, but who were somewhat less endowed with "computer smarts," this challenge turned into a fiasco.

Differences in standards, such as TTL vs. RS-232, resulted in damaged equipment and hurt pride. Luckily, the manufacturers of packet systems took note. Soon, factory-built TNCs were on the market with documentation that made computer and radio interfacing less of an arduous task. Each year, as the state of the art progressed, the TNCs became more capable. As of this writing, most TNCs are effectively multimode controllers that offer a diverse mix of digital modes from packet to SSTV in a single turnkey package. "Plug and play" has become the watchword.

With the present simplicity of packet radio, I found it puzzling that it wasn't being used in portable applications or public service more frequently. In October of 1989 I put together a portable packet system. It consisted of an old 2 meter handie talkie, a standard packet TNC, a Tandy LT-1400 laptop computer, and all necessary cabling. I packed all this into my attache case and headed into the wilderness for my first QRP, portable packet operation (actually the "wilderness" was a hotel room on a business trip).

Upon arrival, I set everything up and found some problems. Packet requires virtually full quieting signals with no interference. The HT with its rubber ducky antenna had to be moved a considerable distance from the TNC to avoid RFI. Even using an external antenna, I couldn't move it far enough from the TNC in the confines of the hotel room to eliminate all RFI. RF from the HT would also get into the TNC, sometimes causing it to lock up. Finally, it seemed that interconnecting the TNC to the computer really enhanced the RFI problems. I used shielded cable, ferrite forms, and all the suggested solutions, to no avail. It seemed that portable packet required a "fixed" antenna located at least 30 feet from the TNC and computer.

Get Rid of the TNC!

Commodore 64 users have a system of "TNC-less" packet, known as DigiCom>64, which has been in existence for several years.

The function of the TNC has been implemented in the Commodore's software. Even through this eliminates the TNC from the RFI equation, another problem is presented. The Commodore 64 and its separate disk drive was originally designed for 120 VAC operation. It can be modified for 12 VDC operation and through use of A & A's DigiCart>64 cartridge the disk drive can be eliminated. However, the "64" still requires an external monitor, generally a TV set. Operators have used this system successfully in portable packet radio, but if there was a way to do the same thing with the IBM-compatible laptop then portable operation is a whole lot easier.

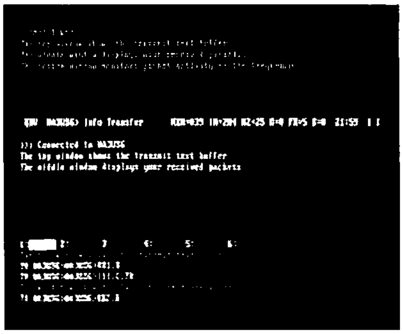
Enter the BayCom TNC-Less Packet System!

Florian Radher DL8MBT and Johannes Kneip DG3RBU of Regensburg, Munich, Germany have developed a program to allow most IBM compatibles to run packet radio without a TNC. Their system really consists of two parts: a shareware program called "BayCom," and a simple modem. The program is available from several sources, including A & A Engineering and many telephone BBS systems, such as CompuServe. Although you can completely home-brew a modem, a new kit which includes HF packet is available from A & A Engineering.

The A & A Engineering Modem

The A & A modem uses the 7910 "World Modem Chip," and is quite easy to build. It came with a high-quality printed circuit board and all the components, and took a total of just two hours to build. It is quite small (approximately 1.5" x 2.5"). Connectors are supplied to interface with the computer (DB9) and the radio (5-pin DIN).

Another nice feature is movable jumpers that allow the push-to-talk (PTT) configuration to be switched from the standard "grounded pin" to various "handie talkie" systems. By simply moving two jumpers and changing a cable, either conventional FM radios or HTs may be used. The PTT function is performed via a relay on the modem board.



The terminal screen for the BayCom packet program. Three window area display transmitted packets, received packets and monitored packets.

The only adjustment on the modem is the transmit audio level. The modem draws about 100 mA from a 12 VDC input. A & A includes a small 12 VDC wall type plug-in power supply with the modem. I found that the 5-volt regulator (7805) ran quite warm. I added a small heat sink on the regulator to keep it cooler.

The only other control on the modem is a switch that selects normal VHF operation, enhanced VHF operation, or HF packet operation. On VHF FM I noticed no difference between the "normal" or "enhanced" mode—both worked quite well. It should be noted that the modem effectively has an "audio" DCD.

Whenever the squelch is broken (by noise as well as by bona fide packets) the DCD light comes on. This causes no problem on FM packet, but on HF SSB noise and static crashes will generate a false DCD. A very nice feature of this modem is its capability to function on HF packet. It's helpful to use an external tuning indicator on HF since the DCD LED on the modem is responsive to any audio. I paralleled the BayCom modem with my AEA PM-1 packet modem (which has a tuning indicator). HF operation with the BayCom system is possible, but any noise or QRM on the frequency degrades its performance. This problem is typical with every HF packet system, however. Finally the A & A modem incorporates a 45 second 'watchdog timer' to prevent QRMing the frequency if there is a malfunction or problem with the computer or modem.

The Program (BayCom Version 1.2)

The Terminal/TNC emulation program is superb! There is a configuration file called "BAYCOM.INI" that must be initialized with your parameters (e.g.: COM port number, callsign, CTEXT, TXD, etc). Most parameters will be instantly recognizable to those with experience in conventional TNCs. Screen colors and screen layout may be modified. Up to nine simultaneous connect channels are supported.

Once the configuration file is set up and the program is booted, the terminal screen will be displayed. This screen consists of three sections: a transmit window, a receive window, and a monitor window. The transmit (or top) window holds data from the keyboard or the file that is to be sent. The receive (or center) window displays data from the station that you are connected to. The monitor (or lower) window displays both transmit and received data, along with the status of the packet, or any system requests (e.g.: connect request) as well as all packet activity on the frequency. The size of each of these windows may be changed to make that window the predominant one. By using the appropriate function key, the cursor may be placed in any window and the window contents scrolled back a number of lines (scroll back buffer size specified in BAYCOM.INI).

Since the computer is essentially the TNC, many parameters not available with conventional packet systems are displayed. The upper window status line contains the operational mode, callsign with SSID, present port state (disconnected, info transfer, frame reject, waiting acknowledge, reject sent).

Another very useful parameter that is displayed is the number of outstanding unacknowledged packets, along with the maximum number allowed. This is valuable information to have on a busy channel. Once the number of outstanding packets reaches the maximum allowed, an automatic disconnect will take place. Monitoring these parameters will flag you to stop generating additional packets until some of the outstanding ones are acknowledged.

Other displayed parameters are memory buffer sizes, Frack time, channel number, connected callsign, time from your system clock, and Com port number.

There is an excellent help screen available via one keystroke. The program has a self-connect mode that can be used without a modem. Issuing a connect request to your own callsign will cause BayCom to connect to yourself. Many aspects of the program may then be tested, exercised, and practiced. Going back and forth between the program and the help screen will help you become an "experienced user" in a matter of an hour or so.

BayCom has the capability to transfer both ASCII and binary files (binary to other BayCom systems). It offers extensive file handling utilities in the form of its diverse command set. Files may be created and edited offline without leaving the BayCom program. Most TNC monitoring functions are supported (e.g. Monitor Heard), as well as functions such as digipeating. Even the connect and disconnect sequences are enhanced with "spiffy" sound effects. For a pure packet terminal program, this is the best that I have ever seen. . . and you don't need a TNC! On an even more positive note, I could detect NO RFI FROM THIS SYSTEM in my radio!

Suggested Improvements

The only real problem that I could find was with the documentation. This consists of an ASCII file on the BayCom system disk. Simply copied to the printer, it generates a complete 49-page users' manual with a table of contents and index. While it contains a wealth of information, its translation from German is, at times, confusing.

Some of the result and error messages generated by BayCom are in German, although these will be changed to English in the near future. While this causes no problems, it is a bit startling. Finally, the modem section in the users' manual is apparently written for a different modem than the one provided in kit form by A & A Engineering. However, if you do purchase the A & A kit, it is "plug and play." The documentation provided by A & A is quite good and it identifies all necessary pin-outs to get both the computer and radio interfaced correctly.

In Summary

BayCom is an absolutely superb system! It is simple to learn and use. It is second to none for portable operations, and should be quite useful in public service and emergency communications. 73

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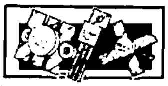

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Project Inspire: A VLF Space Shuttle Experiment

Build a simple receiver to explore the wonders of the 60,000 meter band!

by Jim Ericson KG6EK

Tired of hearing the same old stuff on your radio? Do you tend to think of 160 meters as the "bottom of the band"? This article will discuss both man-made and natural radio activity between 100 Hz and 10 kHz, the absolute bottom end of the VLF (Very Low Frequency) spectrum. If we call 5 kHz the center of the band, we're talking about a 60,000 meter wavelength! I will describe a simple and inexpensive (under $40) VLF receiver design, and present some ideas on how you can participate with space scientists in scientific data gathering involving VLF propagation (and possibly share some of your ham radio expertise with U.S. high school students and other experimenters) during a March 1992 space shuttle experiment. Letters inviting participation in the listening experiment have already gone out to 10,000 high school physics classes in the U.S., and both amateurs and private experimenters are also being invited to participate.

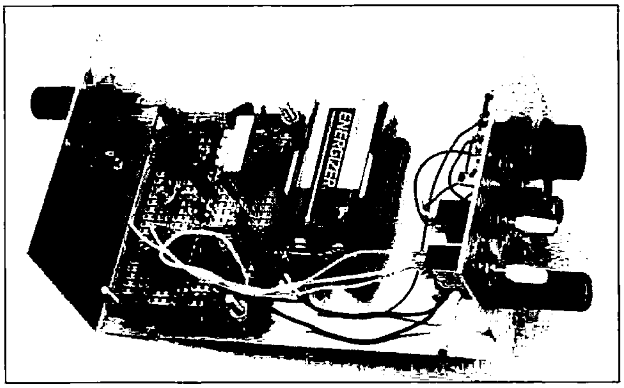

Photo A. The RS-4 VLF receiver layout, using perfboard construction technique. (Photo by Mike Mideke WB6EER.)

A Quick History

The story begins in World War I Europe, where both sides used telephones for trench communications. Soon the vacuum tube came along, opening the way for high gain amplification. Each side began intercepting "leakage" from the other's telephone communications by using amplifiers connected to widely separated ground rods. Electronic Counter Measures were born! Evidently this system worked quite well most of the time, but now and then strange falling notes filled the monitors' headsets, sounding like phantom shells passing overhead.

German scientist H. Barkhausen was assigned to fix this interference problem. He was unsuccessful, but he became intrigued by the mystery. He and other researchers picked at it for years, and by the late 1920s there was general agreement that lightning was responsible for these "whistlers." But it was not until the 1950s that the exact mechanism was found.

As researchers learned, lightning is an enormous spark discharge which produces a broad spectrum of radio energy in which all frequencies appear at once, from hundreds of hertz through hundreds of MHz. However, scientists discovered that a large percentage of lightning's effective radio energy is concentrated in the 1 to 20 kHz region, loosely defined as VLF.

VLF Punches Through the Ionosphere!

VLF static bursts caused by lightning propagate with great efficiency in the waveguide formed by the earth's surface and the lower regions of the ionosphere. Mostly it sounds just like the static you hear on an AM radio receiver. But if you listen closely, you'll sometimes find that somewhere below 10 kHz the static crackles become liquid "pings" or "whistles"...brief musical notes.

Today, the mechanism for this effect is well understood. Radio signals propagating through a non-vacuum medium become dispersed. This means that the higher frequencies travel a little faster than the lower frequencies. A lightning burst starts out as all frequencies at once and propagation in the earth-ionosphere waveguide effectively spreads the frequency components to produce audible "pings" at the lowest frequencies. By measuring this dispersion, investigators can calculate just how far the signals have traveled.

Early investigators were puzzled by the fact that nobody could find signal paths on earth that were anywhere near long enough to account for the huge amount of dispersion heard in long whistles. Eventually, new techniques including spectrum analysis helped to unravel the mysteries of whistlers. L.R.O. Storey of Cambridge University and R.A. Helliwell of Stanford University were among the widespread group which developed a new view of the earth's near-space environment, opening up the field of magnetospheric physics. As it turned out, the long dispersive whistler paths were ducts in the magnetospheric plasma which extend between the Northern and the Southern Hemispheres. These ducts (sort of like the lines you see when you sprinkle iron fillings over a bar magnet) arch to a maximum distance of several earth radii, far beyond the boundaries of our ionosphere. This explains why some whistlers have a duration of several seconds when heard here on earth.

The Antarctic Antenna Farm

In the 1950s, researchers discovered that CW transmissions from military VLF stations sometimes triggered whistler-like events. In the 1960s, they chose Antarctica as a perfect spot for controlled whistler research. Plenty of room to put up a 40 kilometer (26 mile) VLF dipole transmitting antenna, mile-thick ice (a nice insulator to keep the antenna off the "ground," and almost no interference from AC power!

A powerful transmitter was built at Siple Station, Antarctica. In the 1970s and '80s, transmissions from Siple generated a variety

of magnetospheric signals which were recorded by a monitoring station at the magnetic conjugate region near Roberval, Quebec, and by a variety of satellite monitors. These experiments have advanced scientists' understanding of the ionosphere and magnetosphere while suggesting many subjects for further research.

The Need for More Ears

Until recently, VLF research was carried out using only a handful of listening stations manned by the government and a few universities. In 1989, high school and amateur listening participation was invited in a joint NASA/Soviet experiment involving the Soviet satellite *ACTIVE*. The Soviet satellite attempted artificial stimulation of the magnetosphere by passing large 10.5 kHz currents through a 20-meter-diameter loop antenna. Unfortunately, the loop apparently deployed in a twisted configuration, and the SWR was very high. Several months of monitoring by NASA, Soviet observers, and dozens of private experimenters in the U.S. failed to produce any copy. These joint experiments were nonetheless successful in that they provided the first occasion for participation by amateurs and high school groups. The possibilities of a large network of coordinated monitors had never before been explored.

INSPIRE 1992

INSPIRE stands for Interactive NASA Space Physics Ionosphere Experiments. The private industry sponsors who, at this time, are coordinating with NASA include TRW Systems and Micro Power Systems in California, and MESA Art and Printing in Arizona. In March 1992, NASA plans to launch the space shuttle (STS-45) with the first mission in a series of 10 flights called ATLAS (ATmospheric Laboratory for Applications and Science). *[Ed. Note: STS-45 will also be the next SAREX flight.]* One of the ATLAS investigations is called SEPAC (Space Experiments with Particle ACcelerators), which is an experiment involving the earth's atmosphere, ionosphere, and magnetosphere. The 7 kW SEPAC accelerator (see Photo A) will emit a beam of electrons modulated by a series of audio tones from 50 Hz to 7 kHz. A unique feature of the transmitter is that it does not directly utilize a metallic antenna. The modulated electron beam projected into space will become its own "virtual" antenna!

SEPAC will use coordinated high school and amateur experimenter teams to listen and tape record the radio waves. The locations where the transmissions can be detected will define the "footprint" of the signal, an impossible task without a large number of participants.

How to Hear Audio Frequency "Radio" Waves

Radio signals in the VLF region occur at frequencies ranging from a few hundred hertz to something above 10 kHz. These frequencies are readily accessible to human hearing but, even so, they are not directly audible. Why? Because they are electromagnetic events which do not produce the mechanical vibrations in the air that our ears need to detect them as sound.

In order to hear these waves, we must convert their electromagnetic activity to acoustical vibration. Conversion is done with a transducer—a simple amplifier connected to a loudspeaker or headphones—that uses the electrical energy to move air molecules to produce an audible sound.

Building a Practical VLF Receiver

It is fortunate that very simple and inexpensive circuits can be used to hear and record both natural and man-made VLF signals. Beginners can build them; it is not necessary to understand the theory of operation in order to make equipment that works very well.

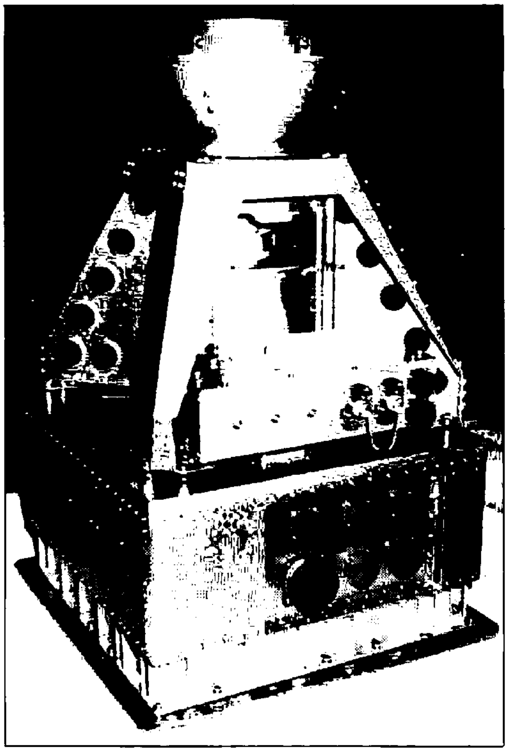

Photo B. The "business end" of the SEPAC Electron Beam Generator. The 7.5 kW electron beam is emitted from the cone at the top. The base (measuring about two feet on a side) is a large heat sink. Peripheral drivers and associated electronics are in a separate module. This experimental package will be mounted on a pallet in the cargo bay of the shuttle. (Photo courtesy of TRW.)

The receiver described here has been dubbed the RS-4 by its designer, amateur experimenter Michael Mideke WB6EER. The identical design (in kit form) will be constructed and used by the participating high school physics classes. All essential components are listed in the current Radio Shack catalog.

The receiver uses a FET input stage to transform the extremely high impedance of a short (1 to 10 foot) antenna to a more practical value. A low-pass filter rolls off frequencies above 7 kHz in order to prevent overloading from high power OMEGA radio-navigational signals at 10.2 kHz and above. The active high-pass filter (controlled by SW-1) significantly rolls off frequencies below 1 kHz, helping to reduce the hum from 60 Hz power line harmonics. A ferrite bead (Amidon FB901-43, available from Amidon Associates, 12033 Otsego Street, North Hollywood CA 91607) in the FET gate circuit helps prevent overloading by radar and TV. Resistor R1 should be shorted via SW-3 when using an antenna longer than about 30 feet. A switch and jack are included to allow the operator to use a microphone for insertion of time marks and commentary while recording.

Note that the receiver uses a jack instead of a conventional power switch. Inserting a shorted plug into the power jack completes the battery negative circuit, applying power to the unit. This approach prevents accidental turn-on of the receiver while it is being transported. (There is nothing more frustrating than pulling the receiver out of your knapsack to discover that it has gotten turned on and the battery is dead!) *[Ed. Note: You can use an SPST switch in place of the jack if you so desire.]*

The layout of the circuit board is not particularly critical (see the accompanying photo for suggested layout using perfboard construction). Try to keep "output stuff" as far as possible from the antenna input. Component values aren't critical either, but try to keep the 11k and 22k resistors associated with U1-A within 5% or so. Since Radio Shack doesn't supply 11k resistors, you can parallel two 22k units, or series-connect a 10k with a 1k.

When all components (including jacks and switches) are soldered in place, it is a good idea to double-check the wiring and do some preliminary tests before mounting the board in the enclosure. The first check is to remove U1 and connect the 9V battery to the circuit, in series with a milliammeter. It should read about 0.5 mA. If the meter indicates much more, or no current at all, something is wrong. Go back and check your work.

The second test is to disconnect the power and insert U-1 in its socket (check for proper orientation). When you reconnect the battery, current consumption should be 3 to 6 mA. If it is, chances are good that everything is OK.

When the receiver is completed, raise the whip antenna a few inches and attach a ground (or several feet of wire if no ground is handy). Listen with Walkman-type headphones or a monitor amplifier, and verify that you have hum and noise. Touching the small antenna, or even moving your hand near it should increase the hum intensity. Switching the high-pass filter in and out should make a noticeable change in the sound of the output. The series antenna resistor will make little difference, whether it's in or out.

Using the Receiver

Even though high-pass filtering is incorporated in the receiver design, it is not a cure-all for the pervasive hum radiated by the AC power lines that dominate our modern civilization. To get reasonable reception of VLF signals, you're going to need to find a site which is at least 500 meters from AC power lines. You'll also need some kind of ground or counterpoise. Usually a simple one-foot nail or spike provides enough grounding to prevent squeals in the receiver. The chassis of an automobile (engine off!) also works nicely. Try the little Radio Shack whip antenna if you are in the open, and maybe a 20- to 50-foot wire if you're in the woods. You will hear some AC line hum, but if you've picked the right site you'll also hear clicks, pops and, with some patience, some whistlers!

Alternatives to Building RS-4 from Scratch

The volunteer nonprofit INSPIRE organization is offering the RS-4 receiver in kit form to the high schools, and the same deal is available to radio amateurs and private experimenters. At $49.95 postpaid (plus $4.12 sales tax in CA), the kit includes:

- All components, enclosure, etched PC board, and detailed assembly instructions.
- *The Beginner's Guide to Whistler Hunting*, by Michael Mideke WB6EER, a 23-page history of VLF, including tips and advice on observing, describing, and recording natural and man-made signals at very low frequencies.
- A 60-minute narrated cassette tape by Mideke which samples the incredible variety of sounds that can be heard in the VLF range. Included are notes describing the audio segments, and sample spectograms of some of the signals.
- Instructional materials designed to assist you in working with high school students to mutually learn more about natural radio and the ATLAS-SEPAC INSPIRE mission.
- You will also receive updates by mail about SEPAC operation schedules, and the status of the mission.

To order an INSPIRE kit, send a check made out to INSPIRE to: Bill Pine, Science Department, Chaffey High School, 1245 N. Euclid Avenue, Ontario CA 91762. If you need a receipt, or have any questions, please include an SASE. If you just want the blank PC board, it's available for $7.

If you decide to build the RS-4 as described in this article, but don't anticipate direct project participation, you may still want to get a copy of the Mideke booklet and audio tape. The Guide is $6 postpaid in the U.S. (plus 83¢ sales tax in CA), $12.50 outside North America. Write Michael Mideke at P.O. Box 123, San Simeon CA 93452-0123.

For those not interested in construction but who would like to experiment with a receiver, Conversion Research has a new VLF pocket receiver available completely assembled for $48 postpaid in the U.S. (plus $3.96 sales tax in CA). The circuit is not exactly the same as the RS-4, but it is fully effective, includes a 33-inch telescoping whip antenna and a battery, and is housed in a sturdy diecast aluminum enclosure with an on/off

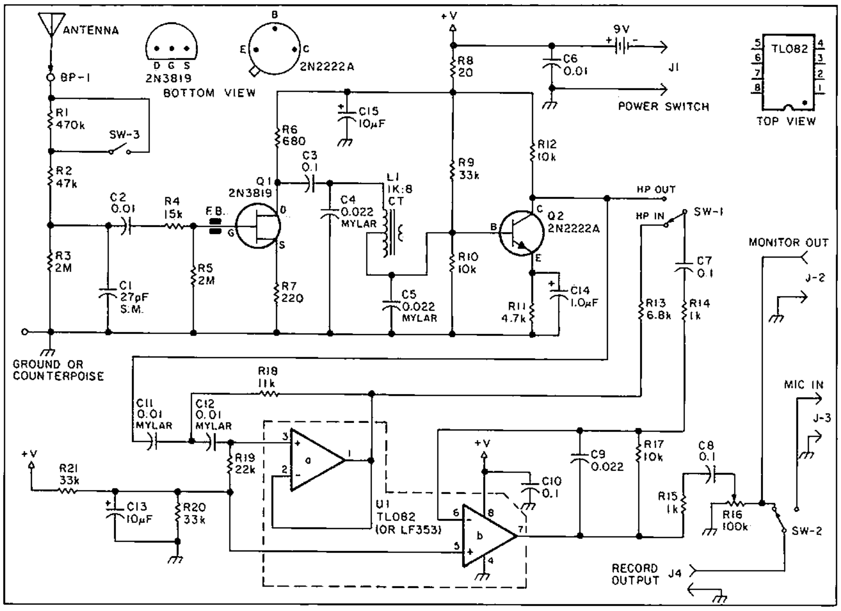

Figure 1. Schematic for the RS4 VLF receiver.

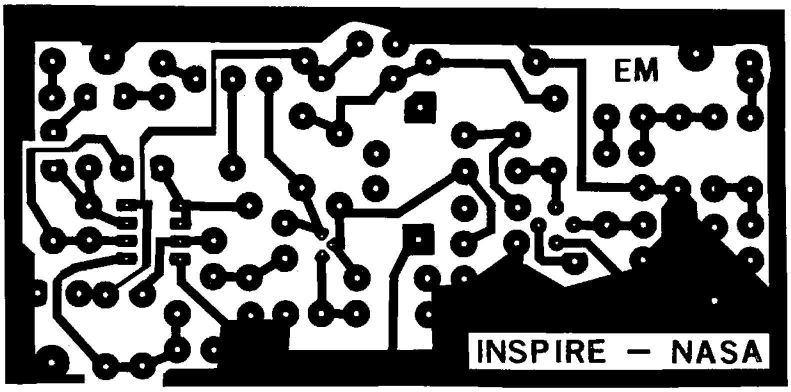

Figure 2. PC board foil pattern for the receiver.

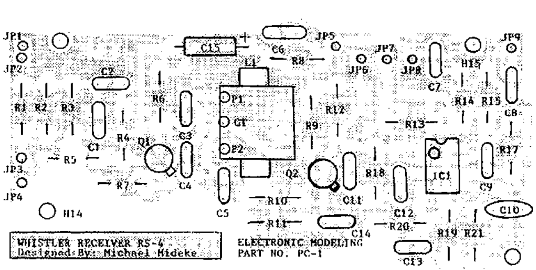

Figure 3. Parts placement diagram.

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Project INSPIRE offers an opportunity for amateurs to be involved in a truly significant research project. To make it fully effective, we amateurs need to bridge the gap between the NASA shuttle experiment and local high schools. Pick up the phone and connect with the physics teacher at your neighborhood high school. If he (or she) hasn't heard about INSPIRE, have them send an SASE to Bill Pine for information. Offer to help students build the kit, and maybe give some advice and assistance in searching out a remote and radio-quiet listening site for the March 1992 mission. Good hunting on 60,000 meters! 73

Contact Jim Ericson KG6EK at 226 Charles Street, Sunnyvale CA 94086-6063.

Parts List

Resistors: Except for R-16, 1/4W metal film 5% units are preferred.

R1	470k
R2	47k
R3	2 Megohm
R4	15k
R5	2 Megohm
R6	680Ω
R7	220Ω
R8	20Ω
R9	33k
R10	10k
R11	4.7k
R12	10k
R13	6.8k
R14, R15	1k
R16	100k, audio taper
R17	10k
R18	11k
R19	22k
R20, R21	33k

Capacitors: 16 volt or higher.

C1	27 pF dipped silver mica
C2	0.01 μF ceramic or mylar
C3	0.10 μF ceramic or mylar
C4, C5	0.022 μF mylar
C6	0.01 μF ceramic or mylar
C7, C8	0.10 μF ceramic or mylar
C9	0.022 μF ceramic or mylar
C10	0.10 μF ceramic or mylar
C11, C12	0.01 μF mylar
C13	10 μF aluminum or tantalum
C14	1.0 μF aluminum or tantalum
C15	10 μF aluminum or tantalum

Active Devices

Q1	2N3819 or similar
Q2	2N2222A or similar
U1	TL082, LF353 or similar

Inductor

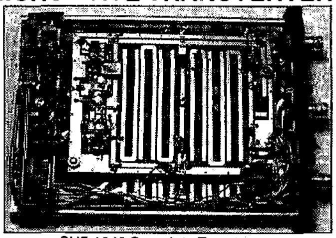
L1	1k c.t. to 8Ω miniature output transformer RS# 273-1380, Mouser 42KMO14, or similar

Miscellaneous

Ferrite bead	Amidon FB901-43 or similar
BP1,2	Binding posts
J1, J3	3.5mm mono jacks
J2, J4	RCA-type "phono" jacks
One 8-pin	IC socket
One 3.5mm	plug for power switch
Perfboard	RS# 276-150
Enclosure	5-1/4" x 3" x 2-1/8"
Battery	9V alkaline recommended. External supply up to 12V can also be used.
Battery clip	DC Electronics #1290 is good.
SW1, SW2	Miniature SPDT toggles
SW3	Toggle or slide OK.
Whip antenna	RS# 270-1408 or similar
Monitor amplifier	RS# 277-1008

NOTE: See text for kit availability.

MICROWAVE TRANSVERTERS



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SHF 2304K	2304-2308 MHz	10mW	Kit $205	Built $325
SHF 2401K	2400 MHz Mode S rcv Conv		Kit $155	Built $255
SHF 3456K	3456-3460 MHz	10mW	Kit $205	Built $325
SHF LOK	540-580 MHz L.O.	50mW	Kit $ 66	

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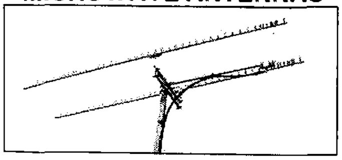

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73 Review

by Larry R. Antonuk WB9RRT

ZD Engineering Hardline Matching Transformers

ZD Engineering
605 Balsley Avenue
Findlay OH 45840
Tel. (419) 424–8765.
Price Class: $28–$30 per pair (available for any band between 144 and 1296 MHz). Other frequencies can be specially ordered—call for price quote. Two-port power divider—$40 including companion transformer.

'A great way to use all of that cheap CATV cable!

Ham radio operators, in general, are a resourceful bunch. Most hams have some experience with making something out of nothing, and just about every amateur product advertised makes you say, "Why didn't I think of that??" The RF hardline matching transformers manufactured by ZD Engineering are just such an item. Not only do these matching transformers allow the use of very cheap CATV coax for ham radio, they also perform environmental and social services as well.

What's So Good About Hardline?

If you're new to ham radio, all of this interest in hardline may be somewhat confusing. After all, why deal with big holes in the wall and stiff, uncooperative cable, when a piece of RG-8 or RG-58 does the same job? The answer is cable loss.

Cable loss refers to the amount of power that is lost on the trip from the transmitter to the antenna. It varies from cable to cable. A percentage of your transmitter power is used up on the way to the antenna due to cable resistance and other factors. This "missing" power is turned into heat which dissipates along the cable rather than being radiated from the antenna.

As you might guess, cable loss increases as the cable gets smaller, and as the frequency gets higher. It also increases as the VSWR increases, which means that you lose even more power in the coax if the antenna isn't properly matched. Loss isn't much of a problem on the HF bands, but on VHF and above, it's a real concern.

For Example...

Consider a 2 meter transmitter feeding an antenna on a tower, with a coaxial cable length of 100 feet. An average loss factor for 100 feet of RG-8/U at 146 MHz might be 3.5 dB. A 100 ft. piece of 7/8" hardline has a loss factor of about 0.6 dB—a difference of almost 3 dB. What this means in terms of performance is that the same difference in radiated signal can be realized by either doubling your transmitter power—or by switching to hardline. (While different varieties of cable have different loss factors, the values presented here represent reasonable averages.)

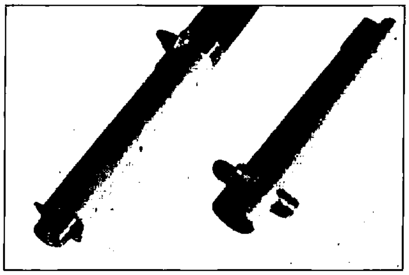


Photo A. 440 MHz Matching Transformer attached to 7/8" line, shown next to 440 MHz power divider.

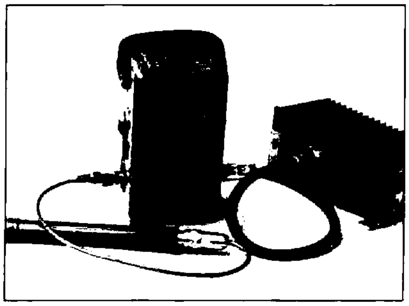


Photo B. 440 MHz Matching Transformer terminated in a 50 ohm dummy load.

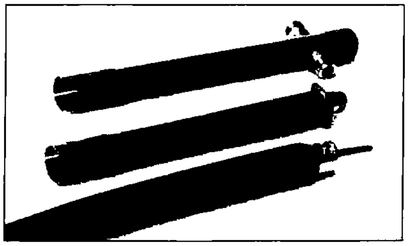


Photo C. 7/8" line prepared for installation of matching transformer and power divider.

If hardline is such great stuff, why isn't everyone using it? As usual, the answer is money! Prices vary, but a good estimate of communications grade hardline, in amateur quantities, is right around "several bucks a foot." Yikes! Not only that, but even if you can get the line for free, the connector prices are prohibitive.

As luck would have it, there is one source of free (or nearly free) hardline. The type of cable used for main runs by CATV companies turns out to be a very high grade of hardline, and it comes in 1/2", 3/4", and 7/8" inch sizes. These cables typically run for miles, and a "short end" to a cable company is often anything less than 500 feet. These "short ends" are often available for the asking—nice long sections of low-loss hardline—just haul them away. But there is one problem—it's 75 ohm impedance cable. And then, you still need to buy those expensive connectors.

The Solution

Fully aware of all of the above facts, the folks at ZD Engineering put two and two together and came up with six. The ZD Engineering Hardline Matching Transformers allow the use of standard CATV hardline for communications use. Each adapter consists of an appropriate connector (UHF or N) and a quarter-wave matching section that mounts on the end of the hardline.

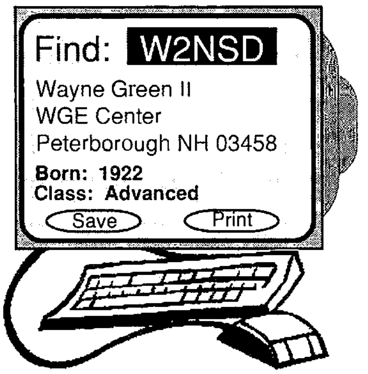
A pair of matching transformers turns a piece of hardline into a flat 50 ohm transmission line (for only $30). It may seem like magic, but the ZD Adapter impedance transformer trick is based on straightforward transmission line theory. One characteristic of a quarter-wave section of transmission line is that it has the ability to match two unequal impedances provided that the impedance of the quarter-wave matching section is of a specific value. The value happens to be the square root of the

Typical Attenuation Figures for 1/2" CATV Hardline

Frequency (MHz)	dB/100 ft.
5	0.16
30	0.40
55	0.54
150	0.90
220	1.11
425	1.57

1992

Throw away your magnifying glass...



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product of the two values to be matched—in our case, 50 and 75 ohms.

The value of the matching section therefore needs to be 61.2 ohms. The ZD Hardline Adapter is simply a quarter-wavelength line, built to the size necessary to produce a 61.2 ohm impedance. The line is then machined to allow mounting to the desired size of hardline, and a connector is silver-soldered to the other end. Although straightforward in design, the adapters provide a feature that makes installation a snap, and prevents a problem that's often experienced with lines of this type.

One of the main difficulties experienced with long runs of CATV hardline has to do with the amount of expansion and contraction that the copper-coated aluminum center conductor undergoes with changes in temperature. Expansion can cause the center conductor to move within the coax, stressing the connections. In extreme cases, the contraction of the center conductor will be so great that it will recede back into the dielectric by several inches.

The ZD Hardline Transformers eliminate this problem by providing a receptacle that's machined to allow the insertion of several inches of center conductor (in the 146 MHz version, the center conductor could be left up to two feet long). This extra length of conductor means that the connection will be making contact regardless of thermal expansion or physical movement.

The coax is simply slid into the adapter, and the inner receptacle holds the center conductor firmly in place. The outer conductor of the adapter is then clamped to the shield of the coax, holding the whole assembly in place. No soldering, threading, or special tools. The ZD Adapters come with explicit installation instructions, and a small amount of anti-oxidizing compound is included in the hardware package.

Transformers are available for 144 MHz, 222 MHz, 440 MHz, 903 MHz, and 1296 MHz. In addition, straight connectors (with no matching section) are available, as are power dividers.

But Do They Work?

The proof of the pudding is in the transmitting, and in this case the ZD Transformers worked just as expected. A series of tests was run using both 7/8" and 1/2" line, at power levels of 10 and 100 watts.

In all cases the measured loss was exactly what was expected from the coax itself—the transformers introduced negligible, if any, additional loss. (See the Table for typical hardline loss figures.) In addition, the transformers produced an absolute flat match into a 50 ohm dummy load. (Due to their high quality construction, the quarter-wave sections probably have a lower loss factor than the cable itself.)

Installation Tips

At this point, it may seem like the ZD Transformers are almost too good to be true. There are a couple of slight limitations that should be noted. First, the physical construction of the adapters could allow water to infiltrate under the outer cable jacket if proper waterproofing methods aren't taken. This can obviously be prevented by the careful use of Coax Seal™. The instructions that come along with the ZD Transformers state that you should wrap Coax Seal so that it overlaps two inches on each side of the junction of the transformer and the hardline. You should make sure the clamp is covered completely by sealant as well.

Second, the length of the adapter is rather long compared to the length of the section of coax that the adapter clamps onto, especially in the 2 meter version. This means that any movement of the adapter will be felt at the cable junction with a fair amount of leverage.

The adapters and the cable should be physically secured to a solid structure (the tower leg or, if indoors, a wall) to keep them from moving, and flexible coax jumpers should make the final connections to the antenna or transmitter. This is common practice in the commercial radio field, but may be something new to some amateurs.

Obviously, these two points are a minor trade-off in order to obtain a piece of low-loss line, but they should be carefully addressed. (The loss factor of hardline increases dramatically if the line is filled with water!)

Saving the Earth

Skeptical by nature, the author decided to check out the claims of all this low cost hardline available at cable TV companies. Obviously, the true value of a product like the ZD Transformer is directly related to how cheaply one can get the hardline. After calls to three cable companies in the area, it was clear that the term "low cost hardline" was something of a misnomer.

More correctly, it should be called "Free—how much do you want?" or perhaps, "We'll give you a few bucks to haul it away" hardline. Environmental awareness, landfill problems, and recycling have finally caught up with the CATV companies. Those "short ends" we were discussing earlier have to go someplace, and the landfill doesn't want to deal with them.

Aluminum scrap collectors used to burn the jacket off and salvage the metal, but burning the cable produces toxic gases—no longer an option. In most cases the short ends and old replaced cable are thrown in a pile, and someone who specializes in scrap cable comes by once a year—and *charges* to haul it away.

One CATV manager proudly told of a deal he worked with a scrap dealer concerning a run of existing cable that was being replaced. After a day on the phone, he finally found someone who would come and get the TWELVE MILES of old 7/8" cable and haul it away in exchange for the aluminum value—a real coup.

Obviously, the cable companies want to get rid of this stuff. Not only are you going to set yourself up with a very low loss antenna line system, saving a load of money in the bargain, you're also doing the Earth a favor. And the social implications? Just think how happy things will be around the house—once you tell the XYL how you saved a thousand dollars on hardline by using ZD Matching Transformers, and then only spent five hundred dollars on a new rig.

Now why didn't I think of that? 73

Number 9 on your Feedback card

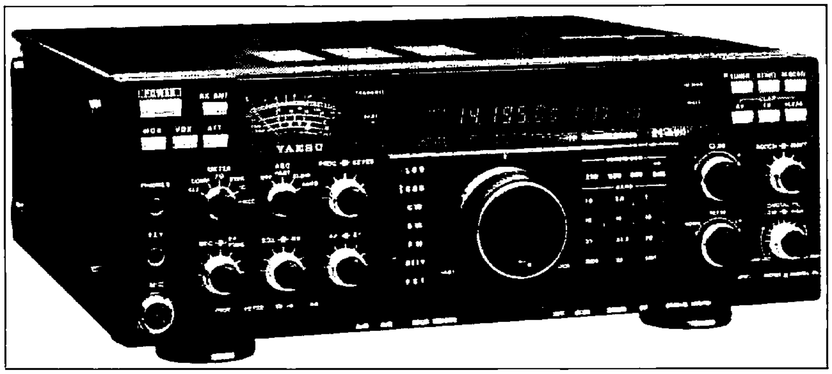
73 Review *by Bill Clarke WA4BLC*

The Yaesu FT-990

A fully-equipped transceiver for the everyday ham.

Yaesu USA
17210 Edwards Road
Cerritos CA 90701
(213) 404-2700
Price Class: $2,400

The FT-990 is advertised as incorporating many of the features found on the FT-1000, yet leaving out some that most hams would seldom use. The result is a fully-equipped transceiver somewhat more affordable than the FT-1000, and more applicable to the typical ham. (See the sidebar for a list of some of the FT-990's features.)


The Yaesu FT-990 HF transceiver.

Operating

Getting the FT-990 on the air was straightforward and took just a few minutes. Only two things are required to operate the rig: AC power and an antenna. This is a complete HF ham station in a single box.

If you are just entering the microprocessor rig era you may find the large number of controls rather formidable, but don't be daunted. The FT-990 is really a very simple rig to operate and the dexterity it offers will be warming to any operator. Most functions are selected via microprocessor control buttons, in contrast to the old wafer switches of yesteryear with their thump-and-bump knobs.

Frequency selection is done with the main tuning knob, which has a very heavy, yet smooth feel. Actually, this can be said for all the controls on the front panel. They operate smoothly and are good-looking. Keypad selection of frequency is simple (except for adding a leading zero below 10 MHz) and, after the memories have been set, selection can be made directly from the memories. There are 90 memories, all tunable and scannable. Of course, there are two VFOs. The frequency readout is excellent and the display also monitors mode, memory number, VFO in use, tuning speed, and clarifier offset (RIT).

The automatic antenna tuner does its work quickly, even when not operating from one of its 39 memories. Typically, it only takes a few seconds. The received audio is a little mushy, to my ears, when all controls are open or centered, but slight adjustments to the DIGITAL FILTER and SHIFT controls make it real sharp (more about these features later). My transmitted audio got many unsolicited reports of "audio really sounds good," which is notable because I was using the hand-mike that came with the rig.

Overall, it is the quality and action of the FT-990's controls that impressed me the most.

Receive Performance

My antenna system is designed to instantly switch from one rig to another, and can be set to parallel rigs on the same feedline. This provides a means to compare performance. During the review process, I operated only in SSB, FM, AM, and CW modes, even though the FT-990 is built with internal interfaces for digital modes (RTTY, packet, AMTOR). I was very pleased with the general receiving capabilities of the FT-990 and I feel it will meet most needs. I still think that the FT-1000 has what I feel to be the ultimate receiver, but it is, after all, more expensive than the FT-990.

The rig I tested had the 2 kHz SSB and 250 Hz filters installed. I found that for signal separation, using these optional filters gave a distinct edge. Overall, the receiver is very tight and does not appear to suffer overloading problems caused by nearby strong signals.

Features and Comments

The Digital SCF filtering is super! I cannot say enough good about this feature. I used it often and was very pleased with its power and ease of operation. The filter consists of two controls that limit the audio bandwidth of the received signal. One cuts out the highs and the other the lows. Both are infinitely selectable and have very steep skirts. This filter is a real plus that isn't even found on the FT-1000.

The SHIFT (IF passband) control is great to use, smoother and broader (easier to tune) than most other rigs. Although the NOTCH FILTER works like it should, I've found that there are some tremendous automatic notch filters in the add-on market. It'd sure be great to see this kind of noth filter available in commercial rigs.

The RF FSP speech processor is unique in that it has a provision for shifting your transmit frequency. It is most effective during pile-ups. The slightly higher-sounding audio really cuts through. Just don't use it on 75 and 40 for local work. You won't be liked very much. This feature can be cloned by operating split, using two VFOs, or by using RIT. But, I doubt if you would consistently be as good sounding or as effective as the FT-990.

If you have never used a rig with an automatic antenna tuner, treat yourself to it sometime. I used multiband wire and vertical antennas for most of my HF work and found the 990's automatic tuner to be perfect for fast QSY. It tuned everything I normally use, with no problems. It did balk at working with my linear amplifier, so in those situations I turned the tuner off.

There is a nice feel to the tuning knob and all the controls are of excellent quality both visually and functionally.

The front feet on the rig are far nicer than the typical wire bails found on most rigs. They drop out of the case bottom, are round, and large in diameter. They are also non-slip!

For the CW operator, a built-in iambic memory keyer with dot/dash memory and selectable weight is standard. The keyer can even be set to simulate a bug. The BFO frequency is adjustable, and a SPOT button allows for precise tuning. A 500 Hz CW filter is standard with 250 Hz optional.

Each of the 90 memories stores frequency, mode, bandwidth, and clarifier (RIT) settings. They are scannable, perhaps nice for keeping track of activity on favorite nets or for FM.

The DVS-2 digital voice recorder (optional device) is basically a solid-state tape recorder.

It is convenient for calling CQ and, with the four short message sections, can be set up to XMIT most of a contest contact. Recording off-the-air is a good feature for repeating missed calls and contact numbers. In addition, as many hams really do wonder what they sound like on the air, particularly when making mike and/or audio changes to their stations, being able to play back on the air is a great feature.

Yaesu does not recommend long transmissions at full power on the FT-990 when operating digital modes. They suggest operating at half power.

The Manual

The manual for the FT-990 includes an excellent tutorial to get you going and does a good job of explaining the function of each control. It is a must-read booklet, as it contains instructions for customizing the transceiver for your own operation (power-up selections). I found the manual lacked some specifications (no stated dynamic range).

Customizing the FT-990

You can customize some of the operations of the FT-990 to suit your particular desires by instructing the rig how to come on when powered up (turned on).

Power-up selection choices are made by holding specified keys/buttons while switching the FT-990 from "off" to "on," and by using DIP switches. Once selected, these choices will be included every time the rig is turned on (until you change them). Some power-up selections are: method of frequency display (offsets for different modes), beeper on/off and pitch, 10 Hz readout, CW pitch, and sidetone volume. This capability makes it easy to turn the 990 into *your* radio.

Recommendations

At a suggested list price of $2,399 you will be getting a high-grade transceiver loaded with bells and whistles, internal power supply, automatic antenna tuner, and digital SCF audio filtering. The rig is also ready for any current digital mode.

Putting these prices into perspective, the FT-990 isn't such a case of sticker shock after all. All you need for general operation is a single all-band antenna such as a G5RV or Windom, a feedline, and a place to plug in the FT-990.

Would I recommend the FT-990? Yes, it offers the features most hams are looking for. Its controls are smooth and very effective, particularly the digital SCF audio filter and shift tuning. And, let's face it, the rig does look pretty darn good!

Some Features of the FT-990

Keypad direct frequency entry
Passband shift
90 memories
Automatic antenna tuner
Dual digital SCF (switched capacitance filter) audio filter
Noise blanker
RF FSP (frequency-shifted speech processor)
All-mode squelch
Notch filter (manual)
Iambic memory keyer
Selectable BFO offset
Spotting button
Key jacks on front and rear panels
Dedicated interfaces for RTTY, AMTOR, and packet
Internal switching AC power supply
DVS-2 digital voice recorder (optional)
10 meter FM operation

SPECIFICATIONS (as taken from the FT-990 Operating Manual)

General
RCVR Coverage: 100 kHz–30 MHz
XMIT coverage

160	1.8– 2.0 MHz
80	3.5– 4.0 MHz
40	7.0– 7.5 MHz
30	10.0–10.5 MHz
20	14.0–14.5 MHz
17	18.0–18.5 MHz
15	21.0–21.5 MHz
12	24.5–25.0 MHz
10	28.0–29.7 MHz

Frequency Stability
<10ppm (−10 to +50 degrees C)
<0.5 ppm (w/TCXO-2 option)
On FM: <200 Hz
Emission modes
LSB/USB-CW-FSK-AM-FM
(J3E-A1A-J1D-J2D-A3E-F3E)
Basic frequency steps
10 Hz LSB/USB-CW-FSK(J1D)
100 Hz AM-FM-FSK(J2D)
Antenna Impedance: 16.5–150 Ω (50 Ω nominal)
Power requirements
Voltage: 110–117 or 200–234 VAC 50/60 Hz
Amperage: 60 VA on RX/470 VA on TX
Dimensions (WHD) 14.3" x 5" x 14.4"
Weight: 28.6 lbs.

Transmitter
Power output
100W (adjustable)
(25W on AM)
Duty cycle
100%
(50% FM & RTTY)
Modulation types
SSB–Balanced filtered carrier
AM–Low-level (early stage)
FM–Variable reactance
FSK–Audio frequency shift keying
Maximun FM deviation: ±2.5 kHz
FSK shift frequencies: 170/425/850 Hz
Packet shift frequencies: 200/1000 Hz
Harmonic radiation: <50 dB below peak output
SSB carrier suppression: <40 dB below peak output
Undesired sideband suppression: <50 dB below peak output
Audio response: < −6 dB (400–2600 Hz on SSB)
3rd order IMD: > −36 dB (100 W PEP at 14.2 MHz)
Microphone impedance: 500–600 Ω

Receiver
Circuit type: Triple-conversion superheterodyne
IF frequencies: 47.21/10.94/.455 MHz
Sensitivity
10 dB S/N, 0 dB = 1 µV
SSB/CW 100–500 kHz <1 µV
SSB/CW 0.5–1.8 MHz <2 µV
SSB/CW 1.8–30 MHz <0.25 µV
AM 100–250 kHz <10 µV
AM 250–500 kHz <2 µV
AM 0.5–1.8 MHz <4 µV
AM 1.8–30 MHz <1 µV
FM 29 MHz for 12 dB SINAD <0.5 µV
Selectivity
6.0 kHzAM Wide: 6 kHz, −6 dB; 15kHz, −60 dB
2.4 kHzSSB/AM/CW/RTTY/Packet: 2.2 kHz, −6 dB;4.0 kHz, −60 dB
2.0 kHzSSB/CW/RTTY/Packet: 1.8 kHz, −6 dB; 3.6 kHz, −60 dB
500 HzCW/RTTY/Packet: 500 Hz, −6 dB; 1.8 kHz Hz, −60 dB
250 HzCW/RTTY: 240 Hz, −6 dB; 700 Hz, −60 dB
Squelch sensitivity
1.8–30 MHz (CW,SSB,AM): <2 µV
28–30 MHz (FM): <0.32 µV
IF rejection: >80 dB (1.8–30 MHz)
Image rejection: >80 dB (1.8–30 MHz)
IF shift: ±1.2 kHz
Maximun Audio output: 2W into 4 Ω load w/<10% THD
Audio output impedance: 4–8 Ω

The QUAG-V

A high performance and wide bandwidth antenna for VHF and UHF.

by Leonard Shick WB3AYW

A broadband antenna is a must for 440-450 MHz. The main problem of most antennas (as well as the matching system) for this band is the ability to achieve a low VSWR over a wide bandwidth while maintaining a high gain. This limits most antennas to a bandwidth of 1 or 2 MHz. By using quagi dimensions for directors and all spacings, the bandwidth of the driven element can be widened to 10 MHz by changing the driven element and the reflector to the double quad design, then bending them at a 90 degree angle. When this is done, all three radiating elements on the driven element reinforce each other at the first director for added gain on both receive and transmit.

In an antenna system with two quad loops driven at the center, there is an impedance of approximately 75 ohms. When used in an array, this can drop to around 50 ohms, which can be driven with 50 ohm coax directly without any matching device. This helps with the simplicity of the easy-to-build broadband design.

Construction Details

The antenna is made from #10 AWG house wiring because of its stiffness and low cost. The boom is made from wood (1" x 2" pine for 70cm and 1" x 3" for 2m). DO NOT USE METAL, as it will interfere with the element length and radiation pattern.

Using a #39 bit, drill all the holes in the boom, except the one for the driven element, which does not get drilled completely through. The undrilled part of the boom between the two holes keeps the two wires from

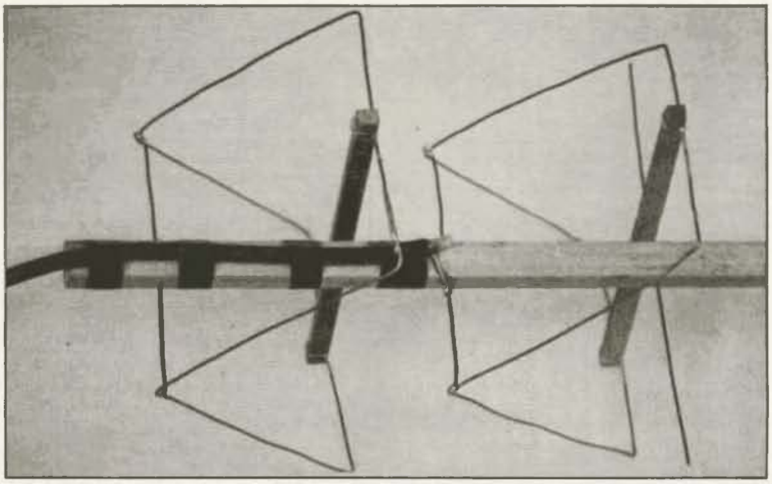


Photo A. Close-up view of the driven element, reflector and feedline attachment point.

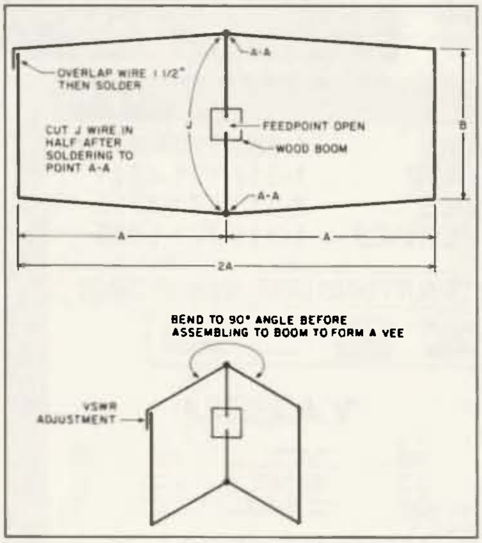


Figure 1. The driven element.

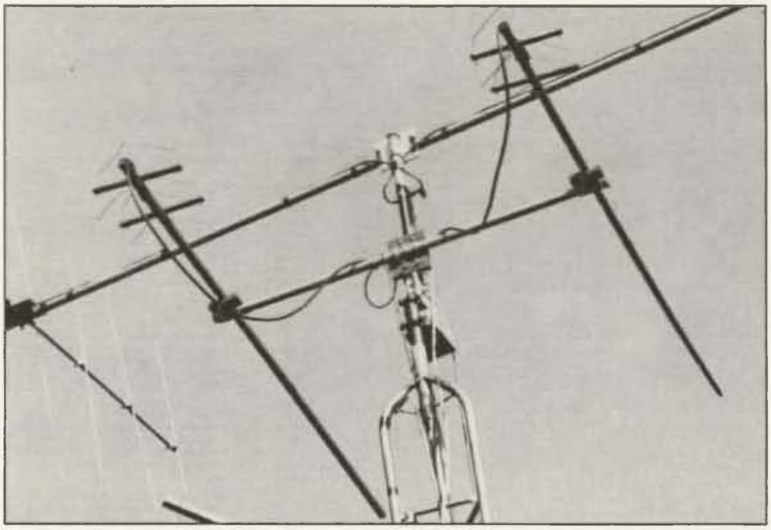


Photo B. Two Quag-Vs can be stacked for additional gain. If you mount the Quag-Vs for horizontal polarization in the configuration shown, you must use a wooden or fiberglass cross support.

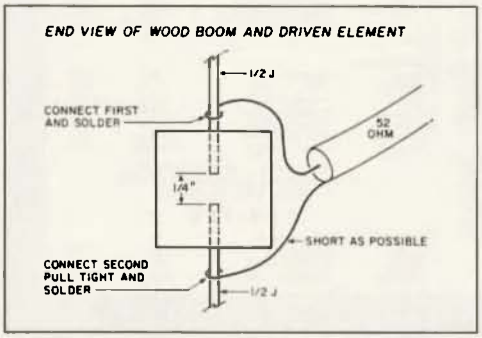


Figure 2. Feedline connection to the driven element.

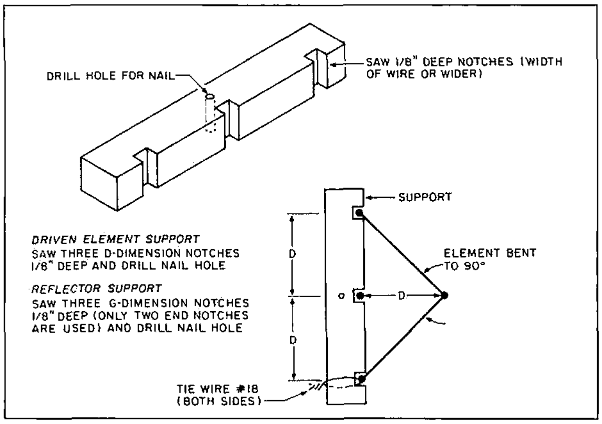


Figure 3. Top view of the driven element and reflector support. The elements are held in place by short loops of #18 wire as shown. The "D" dimensions are used for the driven element and the "G" dimensions are for the reflector assembly (see Table 2).

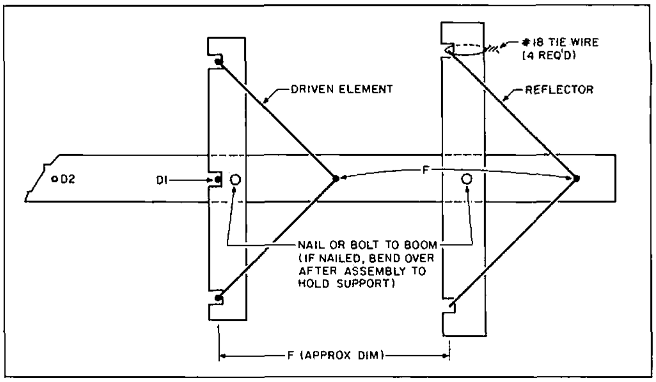


Figure 5. Top view of the driven element and the cross support assembled and attached to the boom.

Table 1. Director Lengths (in inches)

	432	438	446	448	146
D1	11-3/8	11-1/4	11-1/16	11	33-3/4
D2	11-5/16	11-3/16	11	10-15/16	33-5/8
D3	11-1/4	11-1/8	10-15/16	10-7/8	33-1/2
D4	11-3/16	11-1/16	10-7/8	10-13/16	33-3/8
D5	11-1/8	11	10-13/16	10-3/4	33-1/4
D6	11-1/16	10-15/16	10-3/4	10-11/16	33-1/8
D7	11	10-7/8	10-11/16	10-5/8	33-1/8

D8, etc.: Same as D7.

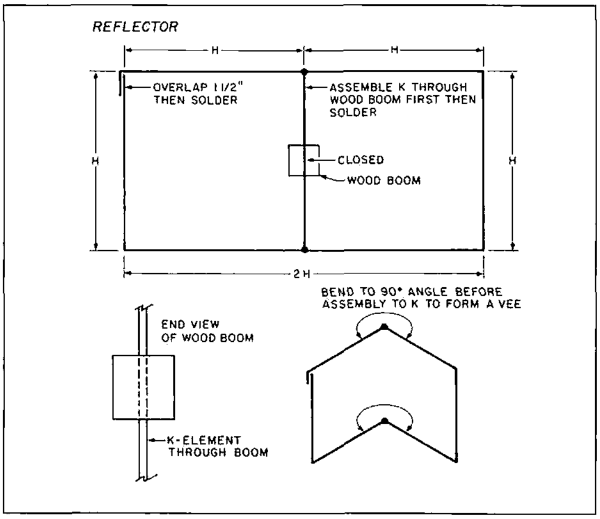


Figure 4. The reflector.

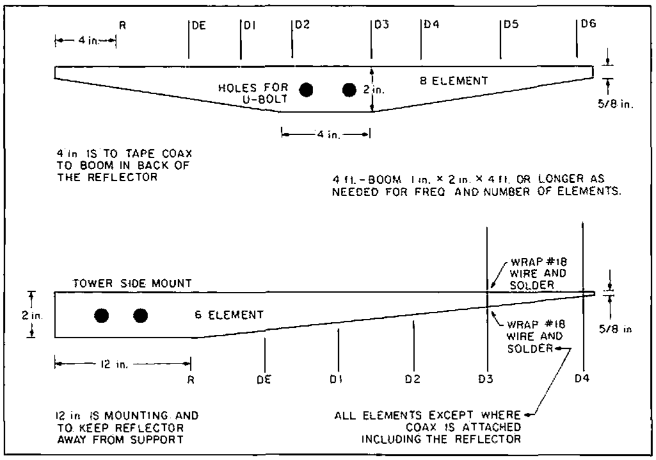


Figure 6. Boom dimensions and element locations. Although not required, you can taper the boom as shown to lighten the total weight of the antenna.

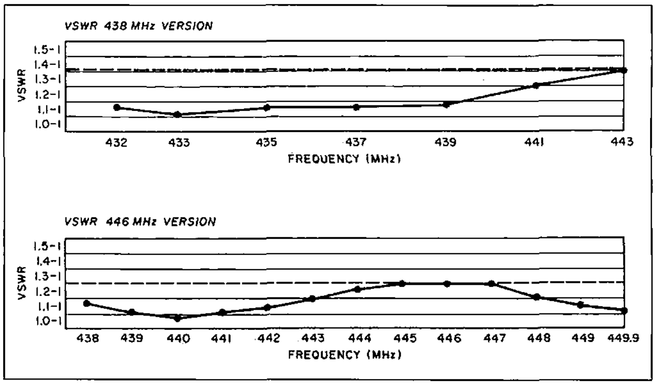


Figure 7. VSWR plots for the 438 MHz and 446 MHz versions.

touching at the feedpoint, and is also the driven element center support (see Figures 1 and 2).

The directors must be cut for the higher portion of the band to be used, so as not to act as reflectors at the highest frequency used. When making the directors, cut carefully, file both ends flat, and then deburr to get the correct length. (A burr on one end of an element can change the length by one MHz or more.)

When mounting the directors, wrap some #18 bare wire around the directors on both sides of the boom, then solder so that the elements will not slide down through the boom.

If the antenna is to be stacked side by side for vertical radiation, the mast can be metal as it will not affect the pattern. For horizontal operation, the mast and supporting structure should be nonmetallic if they are in the field of the radiation pattern.

The support for the front of the driven element and reflector is made of wood, approximately 1/4" x 1" x 12" long. The center of the two wood cross supports is held in place by a nail approximately 2" long, bent over to hold the support from moving. Three notches position the elements in place and two #18 tie wires hold and support the elements to the supports. This ensures that all three vertical elements are the same distance from the first director.

The coax should go from the driven element back through the reflector, then be looped back to the supporting structure. The mast should be of a non-conducting material: wood, fiberglass, etc. A metal mast will change the gain and pattern of the system.

Tuning

When the antenna is complete, adjust the

VSWR by unsoldering the side of the driven element where it is soldered together, then slide it to increase or decrease the length. When you have completed the antenna, and before installation, coat the wood with a latex-base finish to protect it from the weather.

This antenna is similar to the parabeam ("J" beam), but uses the quagi spacings and is bent so that the first director is in line with the outside of the driven element.

At the 1991 W3MIE Field Day, site tests were conducted on the 440–450 QUAG-V, and it showed a much-improved gain and bandwidth over a quagi of the same size. ■

Table 2. Driven element and reflector dimensions (in inches).

Frequency (MHz):		432	438	446	448	146
Element dia. # wire	A	7-3/8	7-7/16	7-1/8	7	21-3/4
	2A	14-3/4	14-7/8	14-1/4	14	43-1/2
	B	5-5/8	5-5/8	5-1/2	5-7/16	16-1/8
	D	4-5/8	4-9/16	4-3/8	4-3/8	13-5/8
	G	5-9/16	5-9/16	5-3/8	5-1/8	14-7/8
	J	6-3/4	6-5/8	6-1/2	6-7/16	19-3/8
	F, H, K	7-1/16	7-1/16	6-7/8	6-13/16	21
Total length of D.E., including overlap		42-1/4	41-3/8	41	40-3/8	120-3/4
Total length of ref., incl. overlap		43-7/8	43-5/8	42-1/4	42	127-1/2
	2H	14-1/8	14-1/8	13-3/4	13-5/8	42

Table 3. 8-Element Material List

Frequency (MHz):	432	438	446	448	146
#10 wire	103″	103″	103″	103″	—
#6 wire	—	—	—	—	26′
Boom (pine or redwood)	1″ x 2″ x 55″	1″ x 2″ x 55″	1″ x 2″ x 55″	1″ x 2″ x 55″	1″ x 3″ x 12′
Cross supports (2)	1/4″ x 1″ x 12″	1/4″ x 1″ x 12″	1/4″ x 1″ x 12″	1/4″ x 1″ x 12″	1″ x 1″ x 32″
Sealant for boom and cross supports	1/2 pint	1/2 pint	1/2 pint	1/2 pint	1 pint
U-bolts	1-1/4″ x 3″ (1)	1-1/4″ x 3″ (1)	1-1/4″ x 3″ (1)	1-1/4″ 3″ (1)	1-1/4″ x 3″ (2)
Tie wire #18	15″	15″	15″	15″	24″ #16

Contact Leonard Shick WB3AYW at 2631 Hershey Rd., Erie PA 16509. Please enclose an SASE. *The author thanks WA3ANA for his assistance in preparing this article and building the prototype, WB3JDI for VSWR and gain tests at the 1991 Field Day site, and K3VLQ and all the others who assisted with the tests.*

Table 4. Element Spacing (in inches)

Frequency (MHz):	432	438	446	448	146
R–DE	7	6-15/16	6-13/16	6-3/4	20-5/8
DE–D1	5-1/4	5-1/8	5	4-15/16	15-1/2
D1–D2	11	10-7/8	10-3/4	10-11/16	32-3/4
D2–D3	5-7/8	5-13/16	5-5/8	5-9/16	17-1/4
D3–D4	8-3/4	8-5/8	8-1/2	8-7/16	25-7/8
D4–D5, D6, etc.	8-3/4	8-5/8	8-1/2	8-7/16	25-7/8

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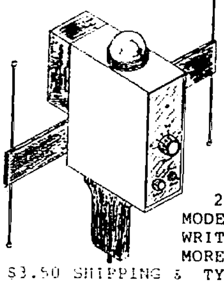

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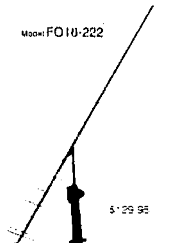

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It doesn't have to be expensive.

by Mike Gray N8KDD

Computer controlled tuning is generally considered the domain of only very expensive receivers. It doesn't have to be that way. This project will show you how to convert an inexpensive receiver kit from a manually tuned radio to a scanning receiver with 10 memory locations.

Receiver kits from Ramsey Electronics are tuned using a varactor diode. A bias voltage is applied to the diode, changing circuit capacitance as a function of the bias voltage. The capacitance is not linear with respect to the voltage, so a little slug tweaking is required to optimize the resolution for the band segment you are interested in. The tuning potentiometers provided with the kits are of high quality, but because they are linear the tuning resolution is reduced at low voltage. In other words, you can't expect as much selectivity when the bias voltage is low. This is not really a problem, and it isn't evident until you find that you have been turning the knob a little too fast and missing some active frequencies. A large diameter tuning knob will make an improvement.

These receivers are an excellent buy, and they perform very well. You can do a lot of experimentation with them without fear of creating a smoldering pile on the bench.

Using these receivers is a lot more fun when a computer does the work. Because computers are digital and the radio kits are analog, a digital-to-analog interface is required. The computer and interface do the same job as the tuning potentiometer, and allow automated control and scanning, too. Computerized tuning allows you to return to a particular frequency easily and accurately. Although absolute frequency cannot be determined without a frequency counter, a very close approximation can be made just by listening for scheduled nets. When you have a couple of absolute frequencies assigned to channels, you can use them as landmarks for unknown frequencies. A frequency counter is not necessary. Ramsey Electronics includes tuning suggestions in the kit documentation.

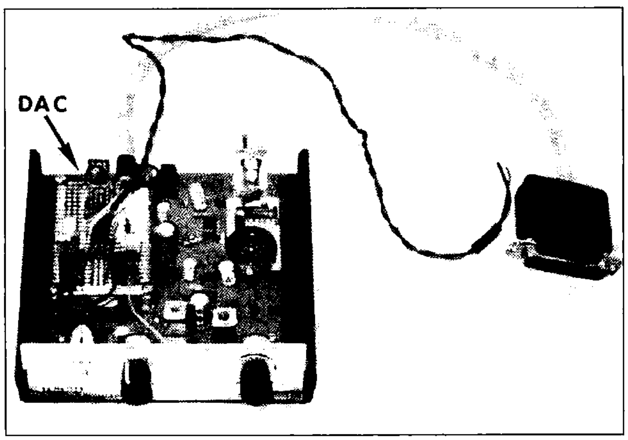

Photo A. Modified receiver (prototype).

Digital-to-Analog Converter (DAC)

The DAC reads 8 bits of data from the computer, then converts them to counts which represent some fraction of the reference voltage applied to the DAC. Two hundred fifty-five counts is equal to 5 volts. An LM10CN op amp is used to buffer the output from the DAC and double the DAC output voltage.

Some of the features of the DAC chip have been disabled because they are not required for this simple project. Only 10 wires connect the DAC assembly to the computer. Eight lines are for data, one is for DAC control, and one is ground reference.

The DAC and receiver together draw less than 25 mA, and both must be powered from a clean 12–13 volt source. The receiver isn't very particular about the supply voltage, but the DAC chip is. It must be powered by a supply which is at least 7 volts higher than its reference. You will have to remove the 9 volt battery holder from the receiver anyway, to make room for the DAC assembly.

Receiver Modification

This really couldn't be easier. Simply remove the tuning potentiometer and run a wire from the DAC assembly output to the center solder pad on the receiver board. Then run another wire from the grounded solder pad to ground on the DAC assembly. The figure shows an HR-4 40 meter receiver. UHF/VHF kits will be similar.

Connect a clean 12 volt (nominal) power supply or battery in place of the 9 volt battery on the receiver board. Make sure the polarity is right. I can't tell you what will happen if it's wrong, but it can't be anything good.

Power for the DAC is taken from the center terminal of the power switch on the receiver kit. Just connect a wire from the top side of the switch to the DAC. That way, the front panel switch controls both boards.

These receivers are very sensitive. You must use a coaxial feedline, and locate the antenna at least 12 feet away from the computer, otherwise you may be listening to computer generated noise. The amplitude of the noise depends upon the receiver frequency, and the clock rate of your computer. A 7 MHz computer will wreak havoc with a 40 meter receiver if the antenna is too close.

I had added an amplifier and a Radio Shack piezo-electric audio transducer to my receiver during the course of a previous experiment. The assembly is located near the antenna connector. It's a big improvement over an earphone, and it sounds pretty good, too.

DAC Construction

The entire assembly could be built on a Radio Shack plated PC board. Photo A shows a switch in my prototype which is not required in the final version. The switch allows the gain of the op amp to be fixed or variable.

We need adjustable gain, so the switch is not included in the schematic.

To attach the DAC board to the receiver board, screw a threaded spacer to each corner of the DAC board. Then apply a little epoxy to the bottom of each spacer and set the assembly on the receiver board.

You can use ribbon or bundled cable to connect the DAC to the 25-in. connector. A complete printer cable can be bought for about $8 from computer discount houses. Buying a printer cable might be cheaper than buying the connector and wire separately. Just cut the printer connector off, and using an ohmmeter, find the wires for pins 1-9 and 25.

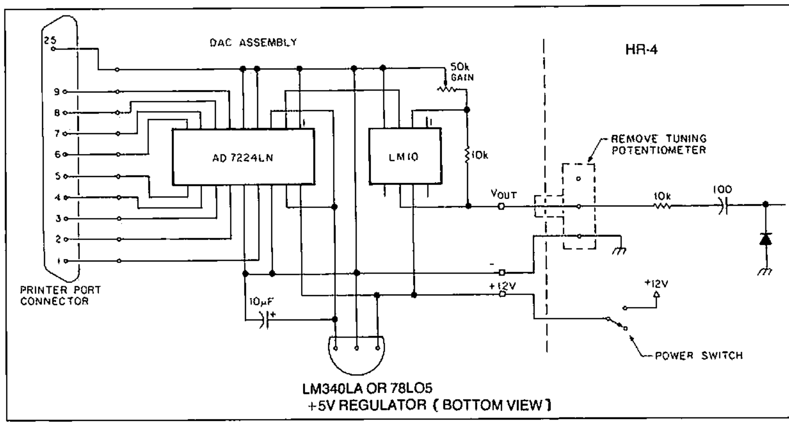

Figure 1. Schematic of the computer interface.

Software

The computer controls the WR line of the DAC chip, and supplies the 8-bit data word, which the chip converts to a voltage. The program must toggle the WR line, and send 8 bits of data to the DAC. The DAC chip will latch the output voltage at the most recent level, until instructed to change it or power is lost.

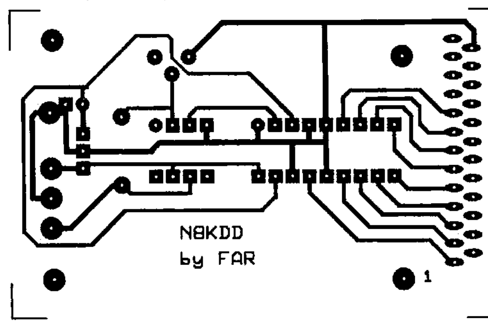

Figure 2. PC board.

The program listing in the sidebar is the minimum required to produce an output voltage from the DAC. The listing prompts you to enter the desired output value in counts.

After you finish assembly of the digital-to-analog converter, run the program and enter 255 counts. Turn the potentiometer until the voltage at pin 6 of the LM10 is 10 volts.

The address of the printer port of most computers is 888. If the circuit does not respond, change address 888 to 956, and change address 890 to 958.

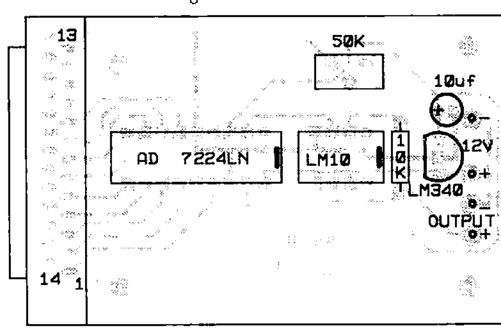

Figure 3. Parts layout.

Find an active frequency by entering a value from zero to 255 when the program prompts you for it. Each time you find activity, write down the D/A counts so that you can return to that frequency just by entering the number. The program kernel shown in the sidebar is intended for experimentation. In order to realize the advantages of computer tuning, a more sophisticated program is in order.

My program is much too long to list completely here. You can write your own program or download mine from the *73* BBS at (603) 525-4438. The name of the program is DAC-TUNE.ZIP, and it will run on PC compatibles with CGA graphics. I can also supply the program on a diskette for $6.

The DAC-TUNE program can scan the entire band (global search), or station presets. When you hit any key, the program stops scanning and executes the command associated with that key. Manual tuning is accomplished with the left and right arrow keys. When you find an active frequency, you can assign it to a channel. You can return to any channel simply by entering the channel number. Station presets, frequencies, and screen colors are saved in a file called SETUP when you terminate the program. These are recalled automatically the next time you start the program. The program operation is self-explanatory.

The DAC chip is relatively new and can be purchased only in lots of 10 or more from the distributor. I can offer kits which include a printed circuit board, DAC-TUNE software, and components. I have not included a printer cable, because cables are often available cheap or free locally. A kit costs $30, which includes shipping and tax. If you just want the 7224 DAC, it's available for $10. The blank PC board is available for $6.

The receiver kits are available from *Ramsey Electronics, Inc., 793 Canning Parkway, Victor NY 14564.*

Contact Mike Gray N8KDD at 465 W. Maple Road, Milford, MI 48381.

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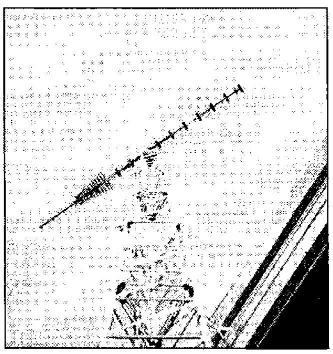

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73 Review *by Gordon West WB6NOA*

ICOM IC-2SRA 2 Meter HT and Scanner

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Price Class: $600

ICOM's new IC-2SRA should really get the attention of the avid ham and dedicated scanner enthusiast. Not only is it a 2 meter hand-held,it also has a built-in wideband scanner receiver.

Two Antennas???

The IC-2SRA looks exactly like the popular ICOM dual-band 2 meter/440 MHz IC-W2A. The buttons, oval magnified LCD screen, and top knob placement are identical. Even the little red power-on button is the same as the ICOM IC-W2A.

But there IS one thing that immediately sets the two units apart when you put them side by side —the IC-2SRA boasts two antennas coming out of the top. That's right, folks—antennas in stereo.

On the first look, you might think someone is teasing you by sticking an antenna speaker/microphone jack on the top of the unit. In fact, when you take a close look at the top of the 2 meter scanner, you'll see that the two jacks are absolutely identical—the left jack for the speaker/mike, and the right jack for the supplied wideband rubber ducky. No BNC jack—no TNC jack—simply an earphone-type jack that the wideband scanning antenna plugs into. It seems to make a good connection, but nonetheless, an earphone jack for an antenna connection?

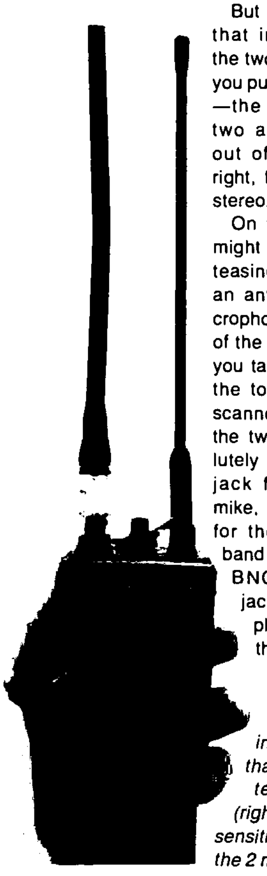

Photo B. Antennas in stereo! We found that the wideband antenna for scanning (right) was not quite as sensitive on 2 meters as the 2 meter ducky (left).

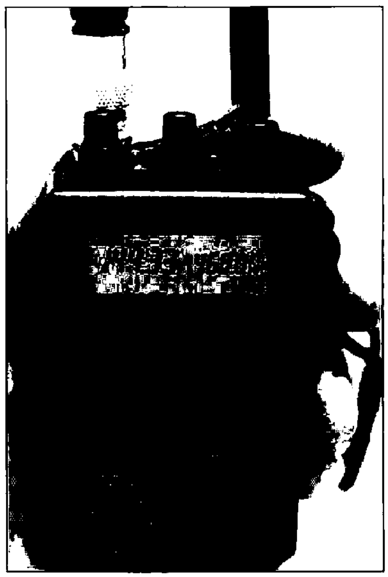

Photo A. The IC-2SRA, showing the 2 meter readout (left) and the scanner frequency readout (right).

The 2 meter side of the ICOM IC-2SRA hand-held transceiver/scanner seems identical to the IC-W2A receiver. The 2 meter receiver tunes from 136.000 MHz to 174.000 MHz, and transmits from 140.000 MHz to 149.995 MHz. We measured in-band receive sensitivity at 0.095 μV for 12 dB SINAD, and 30 kHz selectivity at −60 dB. The 2 meter receiver gave us the good performance we have always found with ICOM hand-held transceivers, in both single-band and dual-band models.

We tested the 2 meter receiver on an outside antenna. There were absolutely no surprises when it came to good rejection to out-of-band paging transmitters, local weather stations, and numerous other high-band signals blanketing my local QTH. On the same outside antenna, some other brand HTs have not fared as well—but, as usual, the 2 meter receiver was nice and tight in a heavy RF area.

The 2 meter transmitter pops on at 140.000 MHz and cycles off at 149.995 MHz. This is good news for those of you in the United States Coast Guard Auxiliary, Civil Air Patrol, or MARS. As soon as you unpack the unit you are on the air on those government frequencies, if you've got the proper license.

Push-Button Programming

Four levels of power output are available from the push buttons. (Table 1 shows what we measured.) When you first set up the programming of your handheld, you may dial in exactly how low you want your low-power output to be. I chose the lowest setting—Low 1—because this only draws 478 mA on my high-power battery pack, as opposed to a whopping 1.34 amps on high power.

The 2 meter side of this transceiver/scanner features all the functions and sub-functions found with a sophisticated handheld. It will take you some time to learn all of the programming steps to

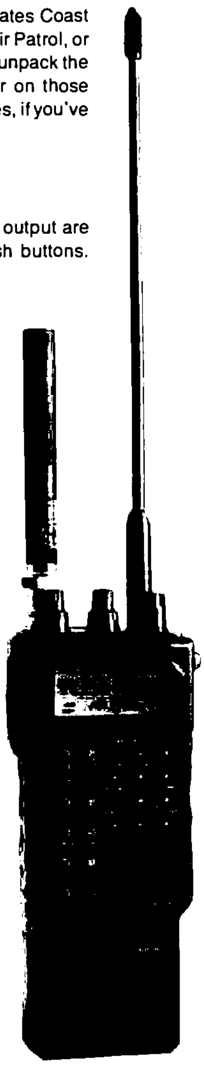

Photo C. The 440 MHz version of the transceiver/scanner. Remember, it is ***NOT*** *a dual-band, only dual-receive.*

Power Selection	12.5 Volts	7.2 Volt Battery
High	5.1 watts	1.6 watts
Low 3	3.2 watts	1.5 watts
Low 2	1.3 watts	1.5 watts
Low 1	0.4 watts	0.4 watts

Table 1. Available power output from push-button selections.

Receive limits: 25.000 MHz through 950.000 MHz
No locked-out band segments; few birdies
Modes: AM, FM, wideband FM
Average NBFM sensitivity throughout band: 0.32 µV for 12dB SINAD
Receiver type: Triple-conversion superhet
Tuning steps: 5, 10, 12.5, 15, 20, 25, 30, 50, 100 kHz (VHF band);
10, 12.5, 20, 25, 30, 50, 100 kHz (UHF and 800 MHz–950 MHz)

Table 2. Scanner/receiver features.

set in your favorite repeater and simplex frequencies in the 30 memory channels, plus the single call channel and two-frequency band edge channels.

Of course, what's a 2 meter transceiver without a clock? That same clock that can turn your unit on can also shut it off. In fact, the clock button is right next to the "enter" button, so you might be seeing the clock come up a lot more often than you want to until you get more precise at poking away at the closely-spaced rubber keypads.

Built-in Scanner

Early press releases indicate that this single-band 2 meter or 440 handheld contains a built-in "wideband receiver." What they are saying is that the single-band 2 meter or the single-band 440 handheld has a built-in, wideband, multimode, 60-memory-channel scanner. (Table 2 lists what we found in the separate built-in scanner/receiver.)

The wideband scanner/receiver is not part part of the main transceiver receiver section. Rather, it's absolutely separate, with its own right-hand LCD readout, antenna port, volume and squelch knob

CH	VIDEO	AUDIO
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

Table 3. TV channels 2–13 audio frequency assignments tuned "WFM" mode on the ICOM IC-2SRA scanner.

squelch knob, and automatic turn-off when you are actually transmitting on the 2 meter band.

This prevents feedback, desense, and potential damage if you're receiving on the same frequency as your transceiver is transmitting. We made that test, and as soon as we hit the PTT the receiver simply blanked out.

And speaking of blanking out—when you begin to program the wideband receiver, as soon as you hit the enter button, the screen goes blank. Do not worry! Start punching in numbers, and the screen jumps to life. This is different from what occurs on the 2 meter side of the radio. On 2 meters there are always a couple of leading numbers to let you know where you are, but on the receive-only side of this transceiver the screen blanks out to allow you to punch in anything from 25 to 950 MHz.

Use the AM mode for tuning in the aeronautical band, the 27 MHz band, or some aeronautical military frequencies in the 200–300 MHz band.

Use the FM mode to listen to regular two-way radio communications. For listening to some pop music on the FM music band, use the WFM (wideband FM) mode. It's easy to select the mode—simply press a single mode key. Be sure to add a leading zero to any direct-dial frequency below 100 MHz. If you don't, you won't hear your popular FM music station at 88.5, because your radio is at 885 MHz!

In the wideband FM mode, you can easily tune into all television audio channels. It comes out crystal clear (except for a birdie on 71.75 MHz, TV audio channel 4, which ICOM indicates they will try and cure), and has a lot more fidelity than trying to tune into a ball game on an old-fashioned AM portable radio. Spend a few minutes, and store your local TV audio channels in the memory for quick retrieval. You can always search out the audio by setting the squelch, and then electronically scanning up. Of course, you can do this at the same time as you are working on the 2 meter side of your transceiver. (See Table 3.)

Unfortunately, the receiver does not go all the way down to shortwave or AM broadcast band frequencies. The lowest you can tune is 25 MHz, and with that little tiny, skinny, rubber duck antenna, any signal below 40 MHz better be real strong.

There will be some ICOM products coming down the line, specifically for tuning in the shortwave bands, but this one won't go below 25 MHz.

To increase your scanner reception, solder up a miniature plug with micro-sized coaxial cable or a good shielded short piece of audio cable. Terminate that to a BNC jack, and this would allow you to plug into a regular outside antenna for improved reception. But a word of caution: The scanner antenna jack is little more than an audio plug receptacle, so don't even consider running a regular piece of RG58AU to it. It could cause the jack to fail.

Another word of caution: The engineers at ICOM recommended at least five feet separation between any external antenna hooked into the antenna jack from a regular transmitting VHF or UHF antenna. I tried this set-up, and didn't blow the receiver—but be careful. With any scanner on an outside antenna, permanent front-end damage might occur if your scanner antenna gets right next to a high-power transmitting antenna.

As for selectivity and intermod rejection, the triple conversion receiver did a good job of canceling out the stuff not on frequency.

I would have preferred a BNC or TNC type connector for the scanner antenna, and it would also have been nice to give you a little bit more "finger room" between the second antenna and the main tuning knob. Also, don't be surprised that the plug-in charger that comes with this unit features yet another design not found on those octopus charging plugs with multiple adapters. But good news—if you already own some ICOM products, the battery packs may be interchangeable, and this includes the drop-in charger, too.

If you are into both 2 meter and 440 MHz (separate units), and also want a built-in scanner, do consider this new offering from ICOM. The scanner capabilities were just as good as with a regular-sized pocket scanner, and the audio a whole lot better from the ICOM communications-style speaker. Best of all, it's one radio with both a built-in ham band and a scanner. 73

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CIRCLE 192 ON READER SERVICE CARD

Not Just Another Island

Weekend DXpedition activates the Walrus Islands.

by Bob King NL7KH

The Walrus Islands are a group of five small islands in the Bering Sea, tucked in along the southwestern shoreline of mainland Alaska. These islands are uninhabited for most of the year, but in the summer their population swells with hundreds of thousands of seabirds—puffins, kittiwakes, auklets and murres.

Thousands of walrus also make the islands their summer home. Male walrus only, though. While the females take care of their young farther north, the men haul out on Round Island, feasting on clams and tanning their bodies on the gravel beaches. It's the ideal bachelor pad, if you happen to be a one-ton pinniped!

Human visitors are rare. Adventuresome wildlife enthusiasts who can afford the trip will venture to the islands to view the walrus and the spectacle of thousands of cliff-dwelling birds. Commercial fishermen are also familiar with the nearby waters, where they cast their nets for herring, salmon, halibut and sole. But before this June, the Walrus Islands have been unknown to the ranks of amateur radio.

Photo A. The KL7N camp on remote Crooked Island, in the Walrus Island chain.

An Island "Vacation"?

"Back in 1988, Chod Harris VP2ML wrote a column for *73* (see DX, July 1988, p. 87) about a group called Islands on the Air," said Scott Diseth KL7N. "In it he explained what IOTA was all about and what islands qualified for the program. He mentioned that Alaska has 24 potential credits, 14 of which have been on the air. Anyone for a DXpedition to Walrus Island this summer?" he asked, kind of tongue-in-cheek.

IOTA members, or "island chasers," as they're known, collect contacts from as many islands or island groups around the world as possible. Many islands, like Hawaii, New Zealand and the Bahamas, are relatively easy catches, but the prospect of a new group like the Walrus Islands was tempting. *[Ed. Note: The IOTA group meets on 14.260 MHz at 1300 UTC Saturdays, 21.260 MHz at 1400 UTC Sundays and on 28.460 MHz just about anytime. Also a list of potential island credits "The IOTA Directory," is available to U.S. residents for $4 ppd. from* The DX Bulletin, *Box 50, Fulton CA 95439.]* Scott, a resident of Dillingham, Alaska, just 60 miles from the island group, decided it was time to take up the challenge. "None of us are IOTA members, but it seemed obvious to me that the Walrus Islands were a rare one, something that people wanted, and it was right in our back yard," he said. "It was kind of a lark, but we were the only ones qualified to activate the islands." Joining KL7N in the expedition were Les Robinson KL7KN, Mike Megli AL7KA and Bob King NL7KH, all residents of Dillingham.

Getting There

Even though the islands are not far away, getting to them was an expedition in itself. Round Island, home to most of the walrus, is a state game sanctuary and access is restricted, so the expedition chose Crooked Island, the second largest island in the chain.

Crooked Island, however, is accessible only by boat or floatplane. Fortunately, the owner of Yute Air Alaska, a Dillingham-based air taxi,

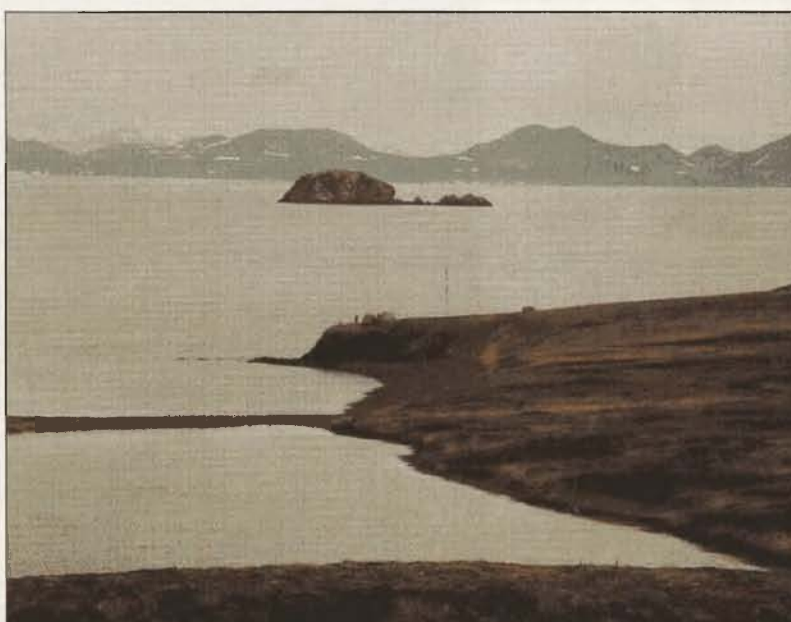

Photo B. The KL7N site and antenna farm on Crooked Island.

is an active ham himself. Will Johnson WA0LKT and one of his pilots, Steve Huddleston KB5GAH, volunteered to help with the transportation. To expedite matters, Steve ferried planeloads of equipment to a beach halfway to the islands, and from there it was transferred to Will and his Cessna 206 on amphibious floats.

It took three trips on each leg. Some of the larger equipment, including a 35-foot crank-up tower and the disassembled antennas, had to be strapped to the plane's floats.

Scott rode over on the first flight to select the site and set up camp. "On the first flight, we took the antennas, the tower, and enough gear for me to survive in case nobody else made it," he said. "You never know what's going to happen."

Fortunately, the weather cooperated with the DXpedition. The skies were sunny and the winds were calm as Will shuttled back and forth with equipment and Scott began to set up the tents and a small farm of antennas.

The radio tent held a Kenwood TS-440 and a Heath SB-200 amplifier. Since the linear drew almost all the current of the generator, the transceiver was run off batteries which were recharged at night. The signal was fed into a Hy-Gain TH-3-JR yagi atop a Tri-Ex 35-foot crank-up tower. A home-brew phased vertical was used as a backup. Having a backup became important as soon as Murphy made his first appearance on the island: Inevitably, the one box that got left back in the hangar 60 miles away contained all the group's tools.

"Yeah, things went pretty smooth, except for forgetting our tools and extension cords," Scott later joked. "But, using some ingenuity, we rigged up a phased vertical system with Mike's leatherman tool and Les's Swiss Army knife. That wasn't enough to put the yagi together, but it worked for the vertical. So score another one for the Swiss Army knife!"

Photo C. Members of the Walrus Island group (l. to r.): Scott Diseth KL7N, Les Robinson KL7KN, Bob King NL7KH and Mike Megli AL7KA.

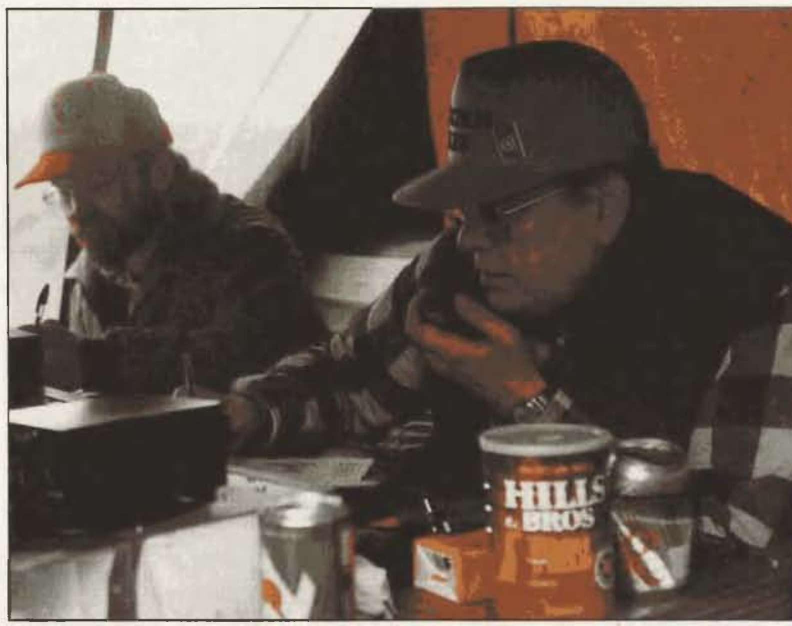

Photo D. Scott KL7N logs contacts while Les KL7KN works the pile-ups.

On the Air

We were still struggling to assemble the antenna, and running out of options on our Swiss Army knife to do it with, when somebody asked, "What time is it?"

The sun was still high in the Alaskan evening sky, but it was already ten minutes past nine. Ten minutes late for our first sked.

Hurriedly, we hooked the rig up to the half-erected vertical just to see if anybody was waiting. Scott whirled the dial on his TS-440 to 14.260 and, sure enough, there was already a pile-up trying to contact KL7N, portable Walrus Island.

With the phased vertical directed north and the rig running barefoot due to the lack of extension cords, KL7N activated the Walrus Island group, designated by IOTA as NA-121, at 0528Z on June 2, 1990.

The first contact came off the side of the antenna, from "Doc" Khalsa KD7SO, in Eugene, Oregon. Doc is IOTA's point man on the West Coast and had helped Scott arrange publicity about the expedition. He had been among those calling for KL7N. In fact, when the group missed its 9 p.m. sked, he had begun to get worried.

"When we were late, Doc called my wife Vickie to find out what had happened to us," Scott recalled. "He was on the phone at 0515 and Vickie assured him that we were out there."

After logging his first 59 report, Scott worked a few more stateside contacts and, as luck would have it, Will's Cessna unexpectedly buzzed the camp to announce the belated arrival of the toolbox. The plane gingerly taxied up to the rocky shoreline. The yagi was quickly assembled and NA-121 was in business.

Over the next day and a half, KL7N logged 464 contacts in 42 countries and most of the United States. Most of the calls came on the IOTA frequency of 14.260, but a few contacts were also made on the 15 and 40 meter bands.

Europeans are the most eager island chasers by far. Contacts were quickly made in England, France, Germany and Italy, throughout Scandinavia, and in Spain and Portugal. Signals flowed freely over the now-crumbled Iron Curtain from East Germany, Poland and Czechoslovakia. Latvian and Estonian hams lined up with Russians to swap reports with KL7N, but it was a most orderly pile-up.

Johnnie Varetto I1HYW provided net control on the continent and ran a tight show, which was appreciated back on the island. "It was kind of a free-for-all with the Americans," Scott said. "It seems like IOTA is a

lot more popular with the Europeans. They're a lot more organized."

While members of the KL7N group took turns making contacts, others hiked around the island, beachcombed, and even tasted herring roe on kelp—a Japanese delicacy which is collected by commercial fishermen on nearby beaches. On Saturday, Will shuttled some of the expedition's families over for a visit. Scott's son Alex celebrated his sixth birthday playing along the shoreline of Crooked Island while his father worked DX, including a call from his father-in-law, Walt Wilson K8AEM, in Marshall, Michigan.

"We cleared the frequency for that," said Scott. "That was the biggest thing that ever happened to Walt."

Actually, Walt has been an invaluable friend of amateur radio in Dillingham. Over the years he has helped get gear for just about every ham in the isolated fishing community. Having a stateside connection is a necessity for hams in remote places like Dillingham, where the nearest Radio Shack is 350 miles away.

Walt also kept tabs on the expedition throughout the weekend. Since almost all the hams in Dillingham were on the island, Scott's wife Vickie had to call her father in Michigan to make sure the group had arrived safely. Mike was able to finally reach home through the Dillingham repeater, but it took an evening climb up a thousand-foot peak, and a ⅝-wave whip on his handie-talkie, to raise the carrier.

Next Time...

Back home now, Scott has been busy verifying the QSL cards he has received not only from hams but from the many SWLers who monitored the expedition.

Despite the complicated logistics and occasional mis-cues, Scott credited the relative ease of the undertaking to past Field Day work. "Without the Field Day experience, we wouldn't have been able to put it together," he said.

"But, I think everybody is Field Day'ed out. I doubt if the Dillingham Club will be on the air this year. Even a weekend DXpedition is kind of a Field Day to the extreme."

But would he reactivate the island again? "Yeah, I think I would in a couple of years," said Scott. "I don't think we worked everybody. There are 2,000 members of IOTA, so it sounds like we only worked a quarter of them. There must be others out there that still need Walrus Island.

And I won't forget my tools," Scott added with a laugh. "Actually, I would have spread my tools out. I wouldn't have had them all in one box."

Scott also said that next time he would try to give IOTA members more advance notice. The KL7N group went out with just two weeks notice. But longer lead time is not always possible in the Bering Sea.

"The problem with those islands is the weather. You can't stick your necks out two months in advance and say you're going to go, because you can't even be sure you're going to make it. 73

Number 14 on your Feedback card

HAM HELP

Your Bulletin Board

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8½" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS/73 MAG Message Area #1. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 525-4438). Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters 1 or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Wanted: A copy of the manual for Dentron 160-10L with 8lla tube, or info on converting 160-10L/572B to 811A. I will pay copy cost and shipping. Ship to *NP4XB/4* or call *(407) 273-3335* from 9 to 5 EST.

I have a Side Band Engineers (SBE)-33. I would like a copy of the schematic and the operating manual. I will be happy to pay postage and copying costs. Thank you. *Joel Kaplan WA7ERH, 1425 E. Ocotillo Rd. #2, Phoenix AZ 85016. (602) 277-2832.*

Wanted by handi-ham: Older HF SSB rig or 2 meter FM equipment dead or alive, inexpensive to repair. Please write to *N3IMJ, 257 Sebring Ave., Pittsburgh PA 15216.*

Wanted: Operating manuals and schematics for Hallicrafter SX-42 (Skyrider Panoramic) 6-band general coverage receiver and Johnson Viking Messenger I (5 channel "white face") 11-meter transceiver. Originals or copies are fine. I will gladly pay duplicating costs and postage. *Kelly Andrews, 8608 Timberwind Dr., Raleigh NC 27615. Day phone (919) 870-0315; evening phone (919) 870-6923.*

Needed: Service and/or operating manual for Hallicrafter's SX-99. I will pay for original or copy. *Luther Hollums N4KTC, 15103 Mahogany Dr., Boynton Beach FL 33436.*

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Arnie Johnson N1BAC
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Notes from FN42

I have received a request for information about Romania, but I have none. Do any of you have news you could send me?

This month's column includes excerpts from five letters from the USSR, which certainly shows the opening of communications to the rest of the world from there.

Dave Horsfall submits his first offering from the land "Down Under." Much food for thought.

I would like to add my wishes to all for the religious season that is upon us, with peace and prosperity for all. Happy Holidays!

And last but almost foremost, I wish to thank Rod Hallen for his faithful reporting from Kenya during the past years. His news is always timely and informative. Best wishes in his move, and I certainly hope that he is able to acquire a license to operate in Pakistan. I am printing a letter from him in the column. Rod, I will certainly be glad to continue you as the new Hambassador to Pakistan. Think it over.—Arnie

N1BAC Roundup

USSR *From Vlad Zaytsev UA4FDS:* In April 1991 Paul UA4FEG and I began planning our second DXpedition within a year. We had operated from UH8W, UH8Y, and UI8U in early 1991 as UA4FEG/. . . and UA4FDS/. . . . We gave serious thought to our next spot. We contacted UZ4FWD, who had been to Asia in 1989, in hopes of obtaining information on making arrangements to get to Uzbek and Turkoman. They gave us a description and a few words about that particular operation. We then prepared our equipment, which included: a new model radio, two amplifiers with modern tubes, a folding 10 meter tower, a 3-band home-brew yagi, cables, guy wires, autotransformer, etc., with a total weight of about 300 kg.

We hope to get to Asia in October for two weeks, operating CW and SSB from those oblasts on all bands except WARC. We hope that conditions will be good and we will get through to all the world.

Please QSL to UA4FDS—Vlad Zaytsev, P.O. Box 555, Penza 440061 USSR (CCCP), or UA4FEG—Paul Bogachev, P.O. Box 222, Penza 440011 USSR (CCCP). We are also good in the *1991 Call Book.* Please QSL with a self-addressed-envelope (SAE) and IRCs or US$.

From Yuri Funkner UL7LS: QSL information for RF6Q/UL7LS is Yuri V. Funkner, P.O. Box 1 Frunze 459411, Ordzhonikidzevskiy rayon, Kustanayskaya oblast, Kazakh SSR USSR.

From Andrey V. Pervacov UA9XC: If you worked any stations from UA9X (UZ9X), Komi, SSR, U-obl:090 from 19 to 24 August 1991; or 4K3, Vaygach Isl., U-obl:114 from 20 August to 2 September 1991, or from Amderma, QSL direct or via P.O. Box 1247, 167001 Syktyvkar, USSR with an SASE. *[Andrey is the president of the Friends Radio Society.]*

From Alex Ulyanich RB5IJ: A new, comprehensive, English-language publication, *Soviet Ham Press Digest,* became available during the summer of 1991. The *Digest,* or *SHPD,* covers all aspects of the exciting world of Soviet amateur radio, and is aimed at amateurs around the world. Topics include ham life in the USSR, DXpeditions, clubs, awards, QSL information, contesting, equipment, and more.

SHPD, edited by Alex Ulyanich, is published by the Prometheus Amateur Association (PAA) of the Ukraine. Letters, articles, pictures, etc. should be submitted directly to the editor.

Subscriptions are available for US$12 and your callsign, name, and address, from PAA, c/o George Yankopolus NA3O, 13 Glen Meadow Drive, Glen Mills PA 19342. Up-to-the-minute member and DXpedition lists are available for IRCs/SASE from PAA, Box 195, 340000 USSR, or to NA3O. It is suggested that applications for membership (one-year US$10 and life US$50), award programs, and fees go to NA3O. *[We received a copy of the first edition, No. 1, August 1991, from Alex. It is 4 pages, 7 1/2 x 11 inches, translated from Russian to English, and appears to be very well done. The PAA also has an award program. I will upload the info to the 73 BBS under "Prometheus Award Program."—Arnie]*

From Sushkov Valery UA3GPA: Sushkov says that he has all addresses of the radioamateurs in the USSR and information about special callsigns, memorial calls, DXpeditions, and other information. If you are having trouble sending or obtaining QSLs, you may want to use his "Express QSL Service". Please SASE for more information to: Sushkov Valery, P.O. Box 3, Lipetsk, USSR, 398000.

AUSTRALIA

David Horsfall VK2KFU
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Hello from "down-under," or, as they say, "G'day." I'll be bringing you news of happenings in Australia, and I hope I can do as good a job as the late Ken Gott. By the way, it's nice to see that the USA has finally created a code-free licence—Australia has had one for almost forty years. Naturally the same gloom-and-doom predictions were made, and again when the Novice licence was introduced in the seventies, and again when Novices gained 2m FM privileges recently. . . . Amateurs certainly seem to be a gloomy lot!

Speaking of code-free licences, the debate is raging once again on the removal of the CW requirement for access to HF bands. The idea is to replace it with extra theory (packet radio perhaps?). Funny how it's mostly the code-free licence (6m and above) that seems to agitating for this! The packet radio system was full of messages on this subject. A lot of people appear to be unaware of the international radio regulations in this respect, although it won't be long before Morse code ceases to be used by the Maritime Service. Whither CW then?

Another battle being fought is the perennial packet protocol wars, this time ROSE vs. NET/ROM. Although NET/ROM is not permitted at the data link layer (due to what some would regard as restrictive Government regulations), it is allowable at level three, and appears poised to defeat ROSE. Given a country the size of Australia where nodes come and go (especially when they get stolen!), the dynamic routing capabilities of NET/ROM makes a lot of sense. As is becoming usual in amateur radio, there is a lot of in-fighting going on, and by the time this appears in print there may be some developments. Indeed, there are rumours that NET/ROM at level two will eventually be allowed, and some hardy souls are already using it. . . . The general feeling is that the government should not ordain how packets travel from point A to point B.

The Wireless Institute of Australia (WIA) has now become the sole supplier of examination papers to accredited examiners around the country. Previously, these examiners composed their own papers and submitted them for approval to the Department of Transportation and Communications (DoTC). This system was beset with various difficulties, with many unsuitable examination papers being rejected, and eventually the DoTC invited the WIA to become the sole supplier. Naturally, this upset a number of people, with all sorts of ludicrous claims being made, such as that the WIA was trying to make money from the system! Hands up, those VEs who are making money from examinations . . . This will take effect from next year, and is being phased in from October. It remains to be seen whether it works or not, but the "debate," if that is not too strong a word, is raging.

Cheers for now.

BRAZIL

Carlos Vianna Carneiro PY1CC
Alfonso Pena, 49/701
20270 - Rio de Janeiro
Brasil

Brazilian QSL Bureau Update! According to the Brazilian Radioamateur League's statutes, delivering QSLs for all associates is one of the league's responsibilities.

In Brazil, a country with continental dimensions, our League has as many branches as states, and now and then, as every other year a new Directory is elected, no one can help eventual misunderstandings and collapsing here and there, hitting points that ought never be touched.

Something like that has hit exactly such an important point: the delivery of QSLs to the DX Bureau suffered during the last year, and we had to put an end to this disaster!

Unfortunately, the words about this were spread everywhere, radioamateurs from Brazil and DX were having troubles with the movement of their QSLs.

Something had to be done. The present President and Vice President of Radioamateurs League in Brazil had a very serious meeting with the EBCT (Brazilian Post Office Enterprise) main authorities.

An agreement was settled granting LABRE special post taxes, 40% lower than usual, a guarantee to the perfect development of these invoices by the Brazilian Radioamateurs League, the real importance of radioamateur being recognized. And in very special deference to all radioamateurs, the EBCT is delivering, by its own, more than one ton of QSL cards still in Brazilia at that time, as a show of what all radioamateurs represent to worldwide communications.

The troubles are over. We congratulate both the EBCT Brazilian Post Office Enterprise and LABRE, Brazilian Radioamateurs League, for this agreement towards the development of friendship, culture, understanding, communication, and goodwill among people of the world.

And to our DX friends, this agreement is surely news, as many of you still need Brazilian QSLs tor awards and files just as we too need the DX QSLs for our awards and files.

Ham Radio in a Marathon! It seems for the first time in the world, as far as we know, a radio amateur joined a Marathon, running more than 42 kilometers, handling and operating a VHF radio, tied to an HF radio through a repeater.

This past June, Sunday the 23rd, Paulo Roberto Domingos Sobrinho PY1ZT, operating with a special callsign of ZY1ZT, left the starting point at Leme Beach in Rio to run the International RIO Marathon, aiming at this "for the first time in the world" title!

Paulo used an Icom IC-2SAT linked to the LABRE's office through a VHF repeater on 147.300 MHz on a mountain near Niteroi City. PY1SCR operated the LABRE Kenwood TS-430S, handling calls to Paulo and trying to keep the battery usage down on the HT.

Even though many problems surfaced during the run (dead batteries and frayed mike cord, fixed with Paulo's teeth while still running), Paulo made 42 contacts on 2m, 40m, 20m, 15m, and 10m.

This year close to 3,000 athletes

Photo A. Paulo PY1ZT crosses the finish line, having made 42 QSOs en route on his IC-2SAT.

Photo B. Members of the Radio Society of Kenya who have worked the Russian satellites listed on the banner in the background.

were running the marathon, and we hope that next year even more will join us for this marvelous event, and who knows, maybe Paulo will break his own record for QSOs made during the 1991 RIO Marathon! After all, running 42.195 km while holding and operating radio equipment to the world deserves respect and admiration from all. Does the editor of the Guiness Book of Records know about PY1ZT and his success? Maybe we need to find out.

By the way, Paulo PY1ZT was ZYØSA at St. Peter/St. Paul DXpedition to the Rocks February/March 1989, together with Ron ZYØSB (PY1BVY).

ISRAEL

Ron Gang 4X1MK
Kibbutz Urim
D.N. Hanagev 85530
Israel
PACKET: 4X1MK@4X4SV.ISR.EU

The Callsign Game. Congratulations to Yosef Lior (ex-4Z9BFB), now 4Z5AA, of Timrat in the Galilee, who holds the distinction of opening up the new block of 4Z5 callsigns.

For some time we were wondering what new prefix would follow in the wake of the completion of the 4X6 series. From 1948 to 1966 the series from 4X4AA through ZZ was issued. Then up til 1988, the 4Z4 block was filled. More than a year ago, the last of the 4X6s, 4X6ZZ, was assigned. Then we started waiting.

Callsign assignment policy was once simplicity in itself. All two-letter suffixes were assigned in alphabetical order, with the Novices having an "N" tacked on which would be deleted upon passing the test for Grade B or Grade A. No old calls were re-issued, and you could tell who was licensed when, according to their call.

In 1987 policy changed, as the Ministry of Communications decided to give Grade A's (Advanced-Extra, approximately) the distinct 4X1 (and later 4Z1) prefix. Their old call could be re-issued to a family member passing the Grade B test. It is said that a few Grade A old-timers, fond of their old 4X4 or 4Z4 calls, refused to be pressured to take on the new "prize" prefix. It still remains to be seen what came out of these few hassles.

Following along with class-distinct callsigns, all Novices became 4Z9s with a three-letter suffix. Upon upgrading, they would be granted an entirely new call.

In the last year, previously unheard from 4X4 calls began appearing on the bands, whose youthful voices revealed that the Ministry had decided to do away with the "holes" in the callbook and issue the unheld calls to new licensees. Your faithful servant resigned himself to the apparent reality of no new prefix for much time to come, as among the 4X4s, 6's, and 4Z4's, a total of 2,028 callsigns are possible, and we don't yet have nearly that many currently licensed hams, not to mention the Grade A's and C's of other prefix distinction!

Unexpectedly, it came to our attention recently that 4Z5AA of the Galilee has inaugurated the long-awaited new series. Prefix hunters the world over—rejoice!

A New Israel Contest. The next Israel-International Contest is projected to take place on April 18, 1992. The rules will be published in our future issues *[if short enough]*. It will be a very interesting contest, with attractive prizes, and will be part of the special 100 hour Pesach activity of the IARC.

Refusing "Hitchhikers" Applying for IARC Membership Dani 4X4YM, chairman of the outgoing Israel Amateur Radio Club Membership Committee, said that there had been 150 new applications for membership in the IARC in the past year, yet only a third of them had been accepted. This curious state of affairs was explained, and later elaborated upon by Mr. Bar Sela of the Ministry of Communications. It turns out that in order to legally purchase a VHF/UHF scanner receiver, the Ministry of Communications requires that the applicant have either journalist's credentials or be a member of the IARC. Thus many people interested in no more than listening to police calls and cellular telephone conversations have been knocking at our door. The policy of the membership committee has been to prefer accepting only those with a real interest in amateur radio, rather than bolstering the club treasury with an additional 8,000 shekels (US$4,236) from those without an interest.

KENYA

Rod Hallen 5Z4BH
Box 55A
APO New York 09675

I've just returned from a mini-DXpedition to the Comoros Islands. I am D68RH down there. I had so much fun that I am planning to go back for the CQ WW Phone Contest the end of October. My tour in Kenya is up in December and I will be moving to Karachi, Pakistan. I've already written to a number of hams there but have received no response yet about licensing. I gather it will be difficult if not impossible to get a license. It will be a dreary two years if that is true.

The enclosed photo is of some members of the Radio Society of Kenya (RSK) who have worked the Russian satellites listed on the banner in the background. The gentleman whose picture is hanging above the blackboard is Daniel Arap Moi, the President of Kenya. The RSK has almost 100 members, but less than a dozen are truly active DXers.

73 from Kenya, Rod 5Z4BH, KB7NK, UK1HR, D68RH. *[We are certainly going to miss Rod's reporting on the goings-on in Kenya and the surrounding area.—Arniel]* 73

Say you saw it in 73!

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Jet-Powered ATV!

Ever wonder what it'd be like to fly a fighter jet? Wouldn't it be great to zip along at treetop level at several hundred miles per hour, buzz the airport in a high speed pass, or experience the thrill of aerial acrobatics?

Of course, it'd be even better if we could somehow experience all this right in our hamshacks without having to subject ourselves to high-G maneuvers. Well, Bill Wagner WB1ADF and Bill Kinton NX1D have worked out just such a system.

Vampire Mobile

Every year, in late September, the New England Escradrille group puts on the Warbirds Air Show at the Manchester, New Hampshire, airport. This is a chance for collectors and restorers of vintage military aircraft to show off their prize aircraft. One of the fighters that would perform during the show was a British training jet called the Vampire. It was manufactured during the '50s and is still in use in parts of the world. One of the interesting features of the Vampire is that it had a small glass porthole directly in the nose cone. A movie camera was usually mounted just behind the porthole and used during combat or training for reconnaissance, or to record the success of a mission. It seemed like the ideal place for a video camera!

Bill WB1ADF and Bill NX1D contacted Ed Stead of Stead Aviation (the owner of the jet) and proposed a way that spectators could ride along with the jet during its flight via an ATV link back to a TV receiver on the ground. Ed thought it was a great idea, and the ATV jet project was ready to take off.

The Remote-Control ATV System

Once the movie camera system is removed, there is a lot of room under the cowling of the jet for an ATV sys-

Photo C. The ATV package fits nicely in the nose cone of the jet. The camcorder looks through the gun camera porthole. (L to R:) Bill Wagner WB1ADF, Bill Kinton NX1D and pilot Doug Wood.

Photo D. Close-up view of the ATV installation. The P C. Electronics TC70-1 was remotely controlled by touch-tone commands received by a small HT underneath the transmitter. An 8mm Ricoh camcorder not only provided the video signal for the ATV transmitter, but also recorded the flight on its video tape.

Photo A. The Vampire ATV jet takes off during the Warbirds airshow. Photo by Charles R. Cole.

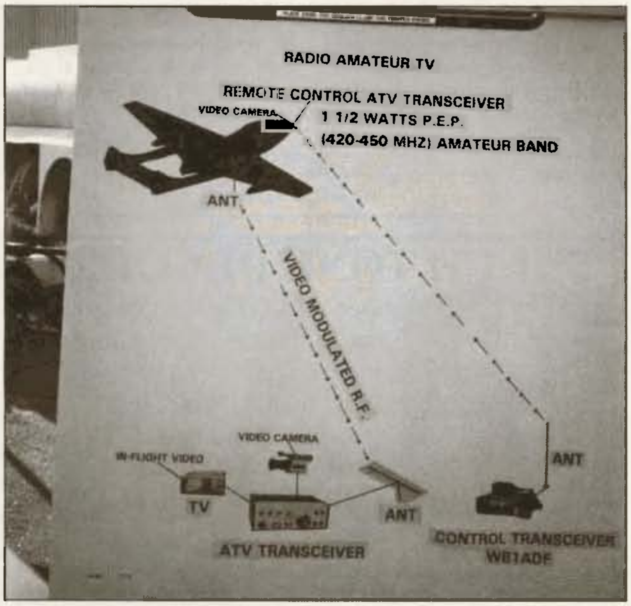


Photo B. The remote control ATV jet system. Chart drawn by Bill Wagner WB1ADF.

tem. Special care had to be taken to ensure that the ATV transceiver (P.C. Electronics TC70-1) and the Ricoh 8mm camcorder were securely mounted. Bill NX1D built up a touchtone decoder circuit and modified the TC70 so that they could remotely turn the transmitter on and off via a VHF link. Also, he had the ability to select more than one video source (in the future they may have a cockpit camera looking over the pilot's shoulder). They originally planned on a 100-watt amplifier but weren't able to cure some power supply problems before the show. The amplifier could also be turned on or off via touch-tone commands.

Since they had a 2 meter uplink, they could use the subcarrier of the ATV transmitter to operate as the output of a crossband voice repeater.

Loops and Rolls

Pilot Doug Wood took up the Vampire on several test flights prior to the scheduled show activities. It was a blast watching him do loops and rolls (without getting TOO dizzy!). Since they had an outside vertical antenna on the belly of the jet, the 1-watt ATV signal did quite well. ATVers as far away as the Boston area (40 miles to the south) had good reception at times, depending on the jet's altitude. A number of the ECAT (East Coast ATV Society) group could also watch the flight via the KA1AFE ATV repeater.

During the airshow, Bill WB1ADF and Bill NX1D had their receive station set up in the back of a Jeep next to a number of display booths. During the jet's flight, quite a crowd of fascinated spectators gathered around, glued to the spectacular views coming down from the ATV system. It was definitely a big hit with the crowd. Believe me, it takes something really intriguing to distract folks from watching passing planes at an airshow! The views from the jet were nothing short of amazing, particularly the high speed passes over the airport. After watching the jet video

Photo E. Bill Wagner WB1ADF mans the ground station during the flight, as fascinated onlookers gather about to watch the fantastic views from the jet.

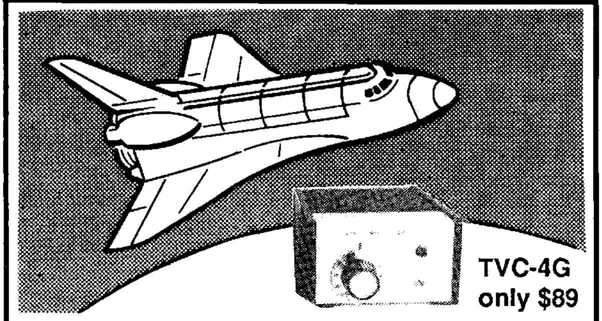
during its takeoff, acrobatics and landing, the crowd all felt as if they had gone along for the ride.

The Next Flight

Look for future flights of the ATV jet. Their next effort may include multiple camera views from the cockpit as well as the nose cone. Also, their 100-watt amplifier system should be in operation for some real DX reception of the jet.

Next month we'll show you the hardware details of the ATV jet system and how you can remotely control your ATV transceiver by touch-tone command. 73

AMATEUR TELEVISION



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UPDATES

Number 17 on your Feedback card

The Mini-Keyer

Refer to the article, "The Mini-Keyer," by Klaus Spies WB9YBM in the May 1991 issue, page 14. The following corrections need to be made for proper operation:

1. A wire is missing from the schematic (see Figure 1 for the updated schematic). The junction of D2 and C3 needs to be connected to pin 7 of U2b. You need to run an additional jumper wire on the PC board to make this new connection as shown in Figure 3. For your information, the combinations of C3/R3 and C2/R2 are contact debouncers for the dash and dot paddle inputs respectively. For dash generation, the U2b flip-flop must receive its clocking input from the output of the U2a flip-flop. When the dash paddle is closed, 5 volts is fed from pin 7 of U2b, through diode D2, to pin 14 of U2a which causes U2a to toggle its output, thereby producing a clock for U2b.

2. Two changes need to be made to the PC board foil pattern: Pin 6 of U2 should be connected to pin 10 of U2. The foil pattern erroneously shows pin 6 tied to pin 11. In addition, pins 3, 2, 10 and 6 of U2 need to be tied to +5 volts as shown in the schematic. If you have already made up a PC board from the original article just cut the trace leading from pin 6 of U2 where it joins pin 11 and attach it with a small jumper or solder bridge to pin 10 instead. Then solder pin 2 of U2 with a small jumper or solder bridge to the +5 volt trace that passes next to pin 2. See Figure 2 for the correct PC foil pattern.

3. Improvements: U3 is shown as a 7432 on the schematic, but is listed as a 74HC32 in the parts list. The circuit is appropriate for a 7432 (TTL) part. If a 74HC32 (High Current CMOS) part is used instead, the C2/R2 values may be modified for much lower power requirements. R2 causes an 8 mA load on the output (pin 3) of U3 as originally shown. If R2 is increased to 4.7k and C2 decreased to 0.005 µF, the RC time constant is maintained but a much lower current drain results. The same values may be substituted for R3/C3 as well. If you want to experiment around, you may be able to increase the value of R2 by two orders of magnitude and still retain proper operation. One final note: You can reduce the current consumption substantially by removing the LED indicator. *[Thanks to Dom Suppappola KA1VCR for this information.]* 73

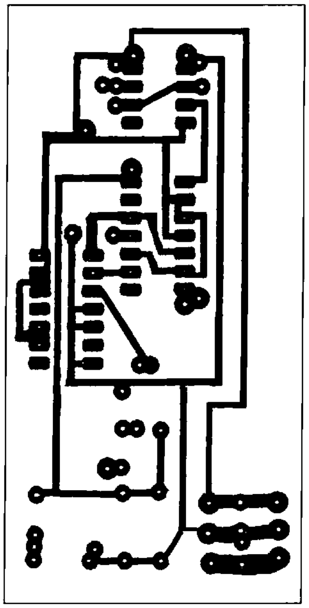

Figure 2. The corrected PC board foil pattern for the keyer.

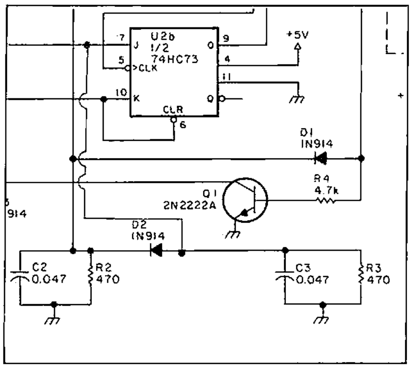

Figure 1. The corrected schematic (new connection shown in red) of the Mini-Keyer.

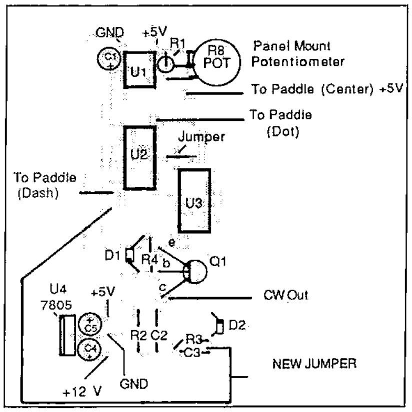

Figure 3. Location of the new jumper wire (shown in red) for the Mini-Keyer.

Number 24 on your Feedback card

HOMING IN

Radio Direction Finding

Joe Moell, P.E. KØOV
P.O. Box 2508
Fullerton CA 92633

RDF Spans the Globe

Writing for *73 Amateur Radio Today* is great fun because you are contacted by enthusiastic readers near and far. In the last two weeks, I received inquiries on radio direction finding (RDF) from South Africa, Germany and Zimbabwe.

It takes personal initiative to get a ham license. You need persistence to study and take exams for upgrades. So, it's no surprise that hams everywhere have a penchant for self-improvement and friendly competition in all forms. Thus, we challenge ourselves to succeed in on-the-air contests, chasing certificates, and breaking VHF/UHF distance records.

Regular "Homing In" readers know that another way hams compete is RDF contesting, often called "foxhunting" or "T-hunting." One ham goes to a special place he's found. Usually it's either hard to find or it has unusual radio propagation to the starting point, where the rest of the participants begin. They will see who wins by getting to the hider first, or perhaps by having the least mileage.

With our love of mobility and inexpensive fuel prices (compared to the rest of the world), it makes sense that hams in the USA would choose mobile over on-foot foxhunts most of the time.

Stateside hunts are local events (no national championship here yet), and rules and customs vary widely. They range from short "first-in wins" events, covering only a few square miles, all the way up to rough-and-tumble marathons where almost anything goes. On the Southern California "All Day" hunt, for example, the boundaries are the continental USA! Of course, you can't get a reliable signal across the country on 2 meters (space shuttle astronauts can't be the hiders), but ending points have frequently been in adjacent states. Once, the hiders were on a mountain over 250 miles from the start.

European Athletes

RDF as a sport in Europe began over 50 years ago, and swept the continent in the '50s and '60s. Enthusiasts soon realized that formal tournaments added to the fun. The first official European Foxhunt Championship Competition was held in 1961, with eight countries represented. It was so successful that it grew into the International Amateur Radio Union Region 1 Amateur RDF (ARDF) Championships, usually held every two years.

Though contestants of any age are welcome, young people usually dominate the winners' positions. They aren't all licensed hams. Only the transmitter operators must have their tickets, so SWLs can and do compete. They must know a little CW, because that is how the transmitters are identified.

Five foxes transmit in sequence, and the hunters must find them in order. It's a map and compass exercise as well as an RDF test. To win, you have to keep track of your own position, and the bearings to the five beacons, at all times.

Many young people have discovered foxhunting from Scouting. At a Boy Scout World Jamboree in Norway, 150 receivers and another 150 kits were produced to give 2,800 participants from 90 countries a chance at "hands on" RDF.

Another major source of European competitors is the military. RDF teams of soldiers and reservists are common. In earlier years, hunts were on 3.5 MHz. Eighty meters is being steadily replaced by 2 meters as the most popular band for cross-country transmitter tracking.

Well-attended Region 1 championships would not be possible without widespread local activity. Many clubs are active in ARDF. Foxhunters like to home-brew their gear, and new designs continue to pop up (see Photo A).

Russian Radiosports

Exposure to technology and physical exercise are both important for young minds and bodies. That is why foxhunting is encouraged in the Soviet Union, especially for teenagers and pre-teens. School radio clubs are common. HF and VHF transmitting and receiving equipment is often hard to come by, and must be made on site. But RDF gear is rolling off a Russian assembly line.

US hams who attended the 1989 Friendship Radio Games in Khabarovsk reported that RDF sets were the only commercially manufactured ham equipment they saw while in Russia. The Barnaul Radio Factory in southwestern Siberia produces toys and electronic products. Flip through the factory's 18-page color catalog, and the first two products you'll see are hand-held RDF sets.

The Altai-145 2 meter sniffer (Photo B) is a complete receiver/antenna unit in one piece, except for headphones. The receiver is built into the boom of a 3-element yagi. It's easy to use—the foxhunter holds it overhead and orients the yagi for loudest signal in the earphones, then heads in the indicated direction. For safety, the yagi elements are made of curved steel tape that folds over instead of impaling the operator or breaking.

Eighty-meter foxhunts remain popular in the USSR. The factory makes the Altai-3.5 for that band, with a similar tuneable receiver and attached loop/spike directional antenna system. The loop is about one foot in diameter. Barnaul makes only one other ham radio product, called a Tisa. It's a transverter to allow 10 meter rigs to transmit and receive on 2 meters.

The Barnaul Production Association is eager to sell its RDF products worldwide. While suitable for foxhunting in some other countries, the design is not compatible with the needs of T-hunters in the USA. The Altai-145 is meant to track CW transmitters and has approximately 7 microvolts sensitivity. US hams usually use FM and require a "hotter" front end. The VFO-tuneable (non-synthesized) Altai receiver is not stable or selective enough to work in the intense RF environment of most cities in the USA.

The Brits are Different

Englanders like foxhunting (both the radio and horseback hound-chasing kinds), but ARDF there is a world apart from events on the European continent. British hams hold their hunts on 160 meters, just as they have for about 70 years.

There are frequent local contests throughout the year, requiring entrants to find one to four transmitters in an afternoon or evening, with winners having the shortest elapsed time. Starters anticipate a drive of 10 miles or so to each fox, followed by a lengthy walk.

After some National Qualifying Rounds, the National Final Championship occurs each September. Three transmitters are hidden in well-spaced locations. They all provide a physical challenge, such as patches of nettles, swamps, and large decoy antennas that re-radiate the 160 meter signals.

The Radio Society of Great Britain heavily promotes RDF outings. RSGB is encouraging members to add 2 meters to local events, and is also setting up European-style hunts. The Society hopes that G-calls will someday be listed among the Region 1 championship winners.

High-Tech in Japan

Nowhere on earth is RDF competition more popular than in Japan, where it's often called "foxteering" or "foxtailing." Just as we have ATV societies

Continued on page 73

Photo A. Roel Bolt PA3CDO tests his experimental 3-element phased array for 2 meter RDF. He also built a companion portable superhet RDF receiver for the local competitions in Apeldoorn, The Netherlands. (Photo by WB6UZZ.)

Photo B. This RDF set for 2 meters is one of the few pieces of Amateur Radio gear being manufactured in Russia. Foxhunting is a regular activity for many school radio clubs there, for both SWLs and licensed hams.

Photo C. Hams in Japan like foxhunts in vehicles as well as on foot. JP1IGV (the driver) and an SWL partner are ready to roll. (Photo by JQ1LCW.)

Number 19 on your Feedback card

HAMSATS

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

9600 BPS Modems

Since the October column, I've received requests for more information about 9600 bit-per-second (bps) packet operation via the University of Surrey low-earth-orbit satellites UoSAT-OSCAR-14 and 22. The effort needed to get on these high speed packet satellites may seem formidable at first, but when the tasks are broken down into separate small projects, it's really quite simple to get a system on the air.

High speed packet activity at 9600 bps is not as common as 1200 bps, but is the only speed currently available from U-O-14 and 22. Radios sometimes require modifications to operate properly in both receive and transmit at this speed, and always need internal wiring additions to make the connection to appropriate high speed modems. This has stopped many potential enthusiasts from becoming active at faster data rates. Future radios will likely have data ports for these connections, but for now, it's necessary to make the changes on stock equipment which the designers never envisioned would be used for these purposes.

Small Projects

To prepare a station for activity at 9600 bps via satellite, there are several items that must be considered. U-O-14 and 22 operate via Mode J with a 2 meter uplink and 70cm downlink. U-O-14's FM uplink is on 145.875 MHz with an FM downlink of 435.070 MHz, while U-O-22 comes down on 435.120 MHz with the uplink on 145.900 MHz. A 9600 bps modem with TNC2-compatible packet controller, FM radios, antennas, a PC-compatible computer, and appropriate software are required to make connection with these bulletin board systems (BBSs) in the sky.

PacComm and TAPR Modems

The component at the heart of any UoSAT earth station is a high speed modem such as those available from PacComm and TAPR (The Tucson Amateur Packet Radio Corporation).

PacComm Packet Radio Systems, Inc., carries different versions of their NB-96 series 9600 bps modems ranging from cards for internal TNC-2 mounting to complete high speed, narrowband radios. For satellite work, either the MCNB-96 modem card for \$109.95, or the EMNB-96 external modem for \$174.95, is fine. The modem design was licensed from James Miller G3RUH and has been in production from PacComm for three years.

These products are not kits. They come complete with cables and instructions for interfacing to existing TNCs and computers. Details concerning the design and use of this modem can be found in James Miller's paper "9600 Baud Packet Radio Modem Design" in the "ARRL Amateur Radio 7th Computer Networking Conference Proceedings" dated October 1, 1988, available from the ARRL. PacComm can be reached at (800) 223-3511 or (813) 874-2980. Their address is 3652 W. Cypress Ave., Tampa FL 33607-4916.

The TAPR high speed modem by Steve Goode K9NG was originally designed for half-duplex operation. Details were outlined in Steve Goode's paper "Modifying the Hamtronics FM-5 for 9600 BPS Packet Operation" in the "ARRL Amateur Radio 4th Computer Networking Conference Proceedings" dated March 30, 1985, also available from the ARRL. A single modem will not provide the full-duplex ability needed for satellite activity. Since a complete kit, including double-sided board and all parts sells for \$35.00, it's cost effective to buy two to create one full-duplex modem.

One TAPR board can be wired as a MOdulator and the other as a DEModulator. The push-to-talk (PTT) line from the TNC does the job for satellite work, thus the original specialized modem PTT circuitry can be omitted on both boards. Clock signals from the TNC are routed to both boards, while transmit audio and receive signals are sent to the appropriate "MO" and "DEM" unit. Integration is simple and only one control, for transmit signal level, needs adjustment. This is set for three kHz FM deviation.

TAPR can be reached at (602) 749-9479, or write to: P.O. Box 12925, Tucson AZ 85732.

The TNC

The high speed 9600 bps modem needs a terminal node controller with a modem disconnect header. A list of U-O-14 users shows that most use variations of the TNC-2 design. In the U.S., many use PacComm TNCs with the NB-96 modem, while foreign U-O-14 enthusiasts have TNC-2s (or clones), with the original G3RUH modem sold by James as a "semi-kit" including a bare board, ROMs and documentation.

The modem disconnect header is the most important feature a TNC needs for 9600 bps use. This allows the internal TNC modem to be easily bypassed. Most TNCs have a disconnect header or a place on the main circuit board to install one. Modem documentation usually provides instructions for cutting one or two lands in the TNC when the external modem is attached.

A useful, but uncommon, feature in TNCs is a data rate to the computer greater than 9600 bps. Buffering problems are possible if both the TNC and computer are used at 9600 bps. Most TNCs are not wired to go faster, but with a few simple modifications, a TNC-2 can be configured for 19,200 bps operation.

The TNC-2 has several speeds for data transfer via the RS-232 jack from 300 to 9600 bps. The 300 bps dip switch setting is the least useful. To replace the function of the 300 bps switch with 19,200, first isolate pin 1 of SW2 from other lands on both sides of the circuit board. Reconnect pin 1 on SW2 to U1 (CMOS 4040) pin 10. If lands are cut to isolate pin 1 on SW2, be sure to reroute wiring that originally went through pin 1. Replace U3 (MC3403 quad operational amplifier) with a faster op amp such as the TL084. The TNC can now be used at 19,200 bps on the computer side when SW2 position 1 (previously 300 bps but now 19,200 bps) is selected.

Radios

A sensitive FM receiver capable of tuning increments of 2 kHz—to allow for Doppler shift tracking—should be used for the downlink. Most receivers have relatively narrow front-end filters

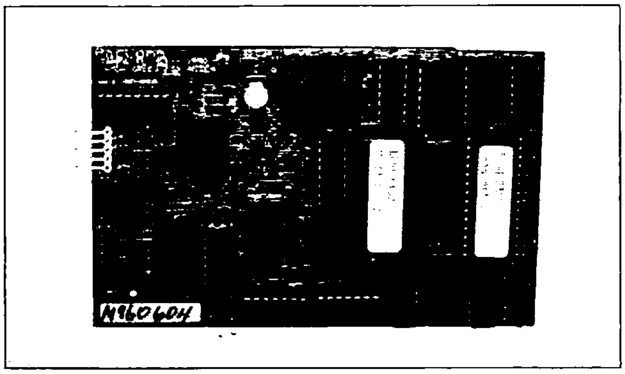

Photo A. PacComm High-Speed FSK modem for full-duplex 9600 bps.

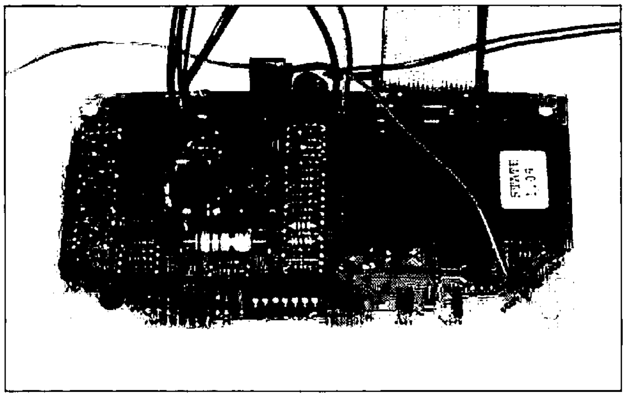

Photo B. K9NG/TAPR 9600 bps modem for half-duplex applications. Two of these modems provide full-duplex 9600 bps.

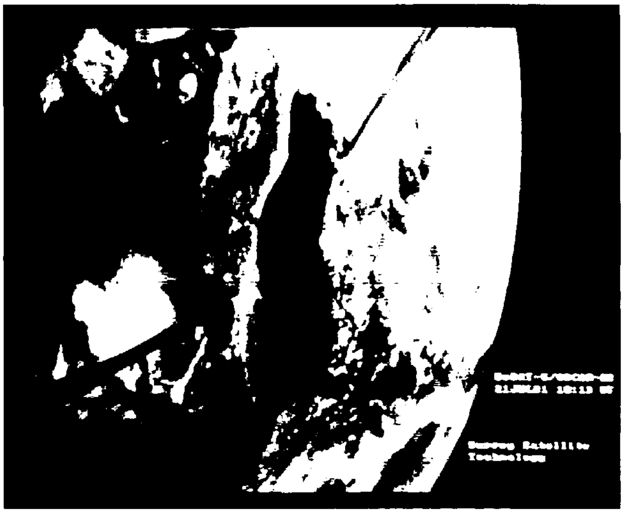

Photo C. A spectacular view from the camera on board U-O-22 as it passes over Italy.

since they're typically used only for voice reception. Although modifications can be made to widen the filters, usually requiring the replacement of a single filter unit, most will work fine without changes as long as the tuning can be adjusted during the course of a satellite pass.

The usual audio output from the receiver cannot be used due to the nature of high speed data. It's too wide for the radio's audio stages. Connection must be made directly to the output of the receiver's FM discriminator circuitry. *The ARRL Handbook* provides examples of what to look for when attempting to identify discriminator circuits.

For many newer transceivers and scanners, the connection is simple. An MC3357 (or similar) IC is used for the FM receiver. A shielded wire to pin 9 is all that is required. For older radios and those without this chip, a schematic search is in order. Generally, the discriminator output can be found just before the audio amplifier stages where two diodes, aimed in opposite directions and connected to a common point, are located.

John Branegan GM4IHJ wrote a very descriptive article, "Low Budget UoSAT-OSCAR 14 9600 Baud Reception" for the September 1990 issue of *The AMSAT Journal*. John described connection methods and bandwidth widening procedures for several radios. Preparing a receiver for 9600 bps reception can, in many cases, be very simple. When a good preamplifier is used in conjunction with a wide front end, tuning increments of five kHz are possible. A Yaesu FRG-9600 scanner works fine without changes and only a simple connection to the MC3357 and the addition of a preamp. The same is true for many other rigs.

A true FM 2 meter transmitter is required for the uplink. Phase-modulated rigs may be difficult or impossible to use without serious modifications. Frequency resolution should be at least 3 kHz, although many operators have done very well with rigs that tune in 5 kHz increments. The power output should be at least 10 watts.

The 2 meter transmitter must be properly connected to the modem. Finding the appropriate modulation input point and correctly setting the drive level are the most difficult portions of this task. The July 1991 issue of the *Packet Status Register* from TAPR contained a short article from James Miller titled "FT-736 and 9600 Baud Operation." James described how to find the varactor diode used in the Yaesu FT-736R 2 meter modulator, and how to drive it properly.

For nearly all transmitters, once the varactor diode has been found, the modem's transmit output signal can be coupled to the low-level, audio input side of the varactor, and adjusted via the modem's transmit-drive level potentiometer for proper operation. The PacComm unit is ready for connection when the drive point is found. The TAPR board should be connected to the radio through a 10 microfarad capacitor (already on the PacComm board). In transmit, the transmitter should be set for 3 kHz deviation.

Antennas

Most U-O-14 and U-O-22 users have directional arrays. This is not because the UoSAT activity demands high-gain arrays, but rather because the antennas are used for other satellite activities requiring large arrays. Very small yagis, home-brew dual-band J-Poles, small helix beams, and even omni-directional antennas have been used successfully for UoSAT work.

If high-gain antennas are used, remember that accurate tracking will be needed to keep the satellite in the useful beamwidth of the antenna. A typical pass may only last 20 minutes from horizon to horizon. If an automated antenna tracking system is not available, the operator will be typing, reading a satellite beam heading list, adjusting for Doppler, and positioning the rotators all at the same time.

Computers

The best software for UoSAT use was written for IBM PCs and their clones. The programs PB, PG, PHS and PFHADD are available free on many BBS systems and include complete documentation on their use. They are also available from AMSAT for a small fee. Write to AMSAT at 850 Sligo Ave. #600, Silver Spring, MD 20910 or call 1 (301) 589-6062 for details.

PB sets the TNC to KISS mode and allows reception of broadcast files from the satellites. It can also be used to begin file broadcasts and fill holes in received files that have been heard but not completely received and stored on disk.

PG provides complete connected uplink and downlink activity with the satellite while PFHADD prepares files for uploading and PHS processes received files for viewing and use.

Hundreds of text, data, picture and voice files have been sent through U-O-14, while dozens of picture files have been made available through U-O-22 in conjunction with its on-board camera experiment.

Try It

Since the launch of U-O-22, many new callsigns have appeared on U-O-14 and U-O-22. Although U-O-14 has been in orbit for nearly two years, this satellite is attracting attention now due to the camera system on U-O-22 (see Photo C for a spectacular view of Italy from this satellite). Hams have discovered the versatility of an international BBS in orbit that can send and receive files of all types at a speed eight times faster than the usual terrestrial system.

Start simple. Get a receive system operational on 70cm and add transmit capability later. Work on enhancements like faster computer-to-TNC data rates and receiver bandwidth widening when the time and money are available. Join the pioneers on the cutting edge of amateur satellite technology.

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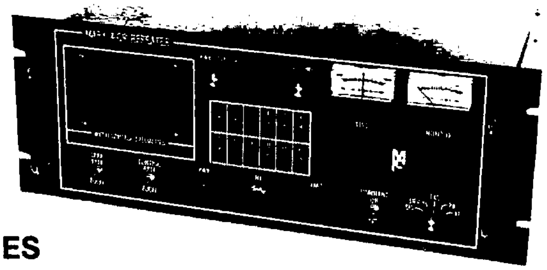

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CIRCLE 144 ON READER SERVICE CARD

The "Cheap and Simple" Power Supply Revisited

Improved regulation for a classic power supply.

by Vern A. Weiss WA9VLK/GØNBZ

The year 1981 gave us our hostages back, our White House Gipper and our first space shuttle mission. It also gave us "Cheap and Simple, your basic 13.8 volt, 25-A power supply," published in the January 1981 issue of *73 Magazine*. This article described a 13.8 VDC (variable if you want), high-current supply capable of delivering 15, 25 or even more amperes. The circuit was certainly more than adequate for the likes of me, but for some of you, its 0.4 VDC drop at full load was unacceptable.

The other day when Gorbachev and I were on the phone discussing this no-code thing, he said to me, "Can we really get Hewlett-Packard regulation at bargain-basement prices?" I replied, "Probably not, but maybe we can come close." There are better voltage regulators around than the 7812, which is the one specified in the 1981 "Cheap and Simple" article. You have to go a long way to beat the LM317 or LM200H. But let's stick with the 7812 because it's very affordable and it's always available at the local Radio Shack.

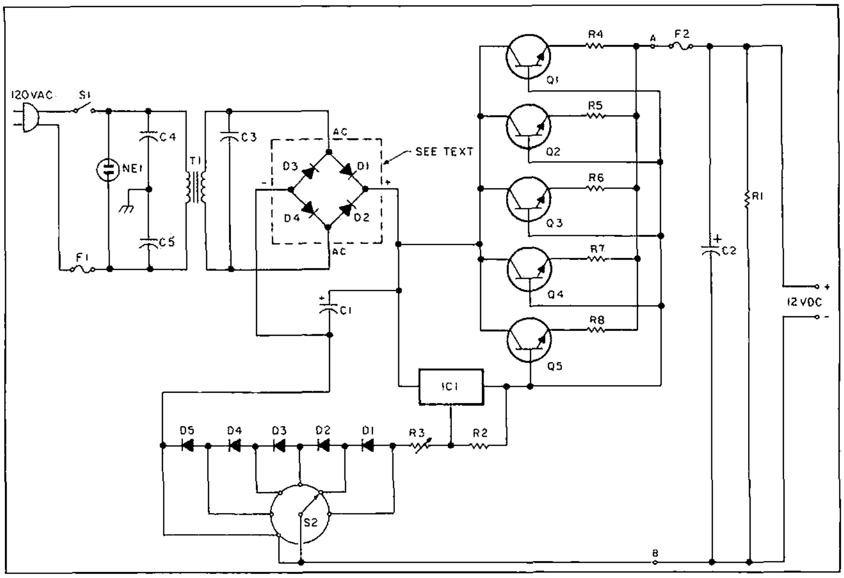

Figure 1. The original "Cheap and Simple" circuit as it appeared in the January 1981 73 Magazine article.

Revising the "Cheap and Simple"

Figure 1 shows the original "Cheap and Simple" circuit. Enjoy switch S2 and diodes D5, D4, D3, D2 and D1 while you have them because in the new circuit (Figure 2) they will be gone.

What we have done is simply establish output voltage feedback so that IC1 can compensate for voltage decreases under load. Monitoring the output voltage, as we have done, improves regulation. That will keep Daniel Ortega and other critics of my 0.4 VDC full-load drop happy.

Another hint for builders of this supply is to switch capacitors C1 and C2. The January 1981 article's "Parts List" showed C1 as a 13,000μF, 25V electrolytic and C2 as a 10μF, 25V electrolytic. The parts list should have shown C1 at 10μF and C2 at 13,000μF. If you followed the text, your project probably went smoothly, but if you relied too heavily on the parts list (and, I admit, I am as guilty of this as the next guy), your capacitors may have become impossible to get along with.

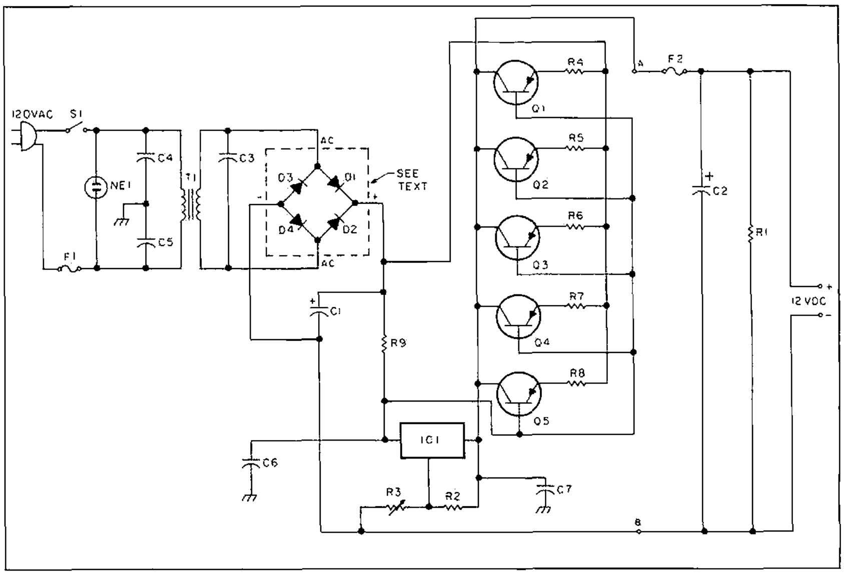

Figure 2. The modified power supply circuit monitors the output voltage, thus improving voltage regulation.

Component parameters can differ greatly between companies, especially when we start comparing a new component with one that has been stored beneath the septic tank since 1960. If your supply isn't performing like you think it should, and you've followed my suggestions to a tee, try **NOT** following them to a tee. Experiment with other components of similar values. I would not, however, actually imply that you should use **NEW** components, fresh and within manufacturer's tolerances. That approach gets into money that defeats the purpose of "Cheap and Simple." We are ham operators, remember, and pride ourselves in building anything electrical from common items found easily in any household in America. 73

Contact Vern A. Weiss WA9VLK/G0NBZ at 4259 Park Place, R.R. #5, Lakes of Four Seasons IN 46307.

Revised Parts List

C1	10µF, 25V electrolytic capacitor
C2	13,000µF, 25V electrolytic capacitor
C3	0.22µF, 100V tubular capacitor
C4, C5	0.01µF, 500V ceramic capacitor
C6, C7	0.1µF ceramic capacitor
D1–D4	25 amp diodes or bridge rectifier
F1	5 amp fuse
F2	30 amp fuse
Q1–Q5	2N3055 transistors (mount on large heatsink)
R1	120Ω, 4W resistor
R2	220Ω, 1W resistor
R3	5k Ω, 2W resistor
R4–R8	0.25Ω, 1W resistor
R9	6.2Ω, 1W resistor
IC1	7812 voltage regulator
S1	SPST switch
T1	120/17–24 VAC power transformer (NOTE: must be able to handle full current)

Miscellaneous: NE1 neon bulb, binding posts, line cord, 0-25 VDC voltmeter, 0–30 amp ammeter, heat sinks, chassis, blower, fuseholders, and bulb socket.

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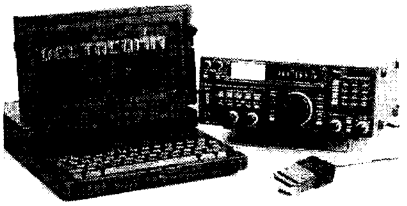

- CYBERSCAN™ allows scan file tracking control of systems employing frequency hopping techniques.
- Birdie log during frequency search automatically characterizes your R7000, then locks out those frequencies during frequency search operation.
- Custom interface has electronics to allow software control (by channel number) of external tape recorder.

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DELTACOMM™ I-71 Version 4.0 offers read/write control of your R71 receiver's frequency, mode and memory channels. Additional program features include auto log frequency search, scanning, timer/clock event management, data base management, pull-down menu windows, split screen for your Terminal Node Controller (TNC) communication needs and the ability to control an antenna switching system or logging tape recorder.

- Data base management allows definition of frequency, call sign, time schedule, mode, target area, country, 140 character notes field, 69 character TNC command field, QSL status, control relay status and, in addition, displays user defined optimum settings of receiver front panel knob positions.
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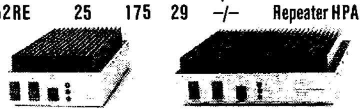
50 MHz					
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	–/–	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	–/–	Repeater
0550G	10	400	60	15/0.6	HPA
0550RH	10	400	60	–/–	Repeater HPA
0552G	25-40	400	55	15/0.6	HPA
0552RH	25-40	400	55	–/–	Repeater HPA
144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	–/–	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	–/–	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	–/–	Repeater
1450G	10	400	54	15/0.6	HPA
1450RH	10	400	54	–/–	Repeater HPA
1452G	25	400	50	15/0.6	HPA
1452RH	25	400	50	–/–	Repeater HPA
1454G	50-100	400	45	15/0.6	HPA
1454RH	50-100	400	45	–/–	Repeater HPA
220 MHz					
2210G	10	130	20	12/0.7	Standard
2210R	10	130	19	–/–	Repeater
2212G	30	130	16	12/0.7	Standard
2212R	30	130	15	–/–	Repeater
2250G	10	220	42	14/0.7	HPA
2250RH	10	260	45	–/–	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	280	40	–/–	Repeater HPA
440 MHz					
4410G	10	100	19	10/1.1	Standard
4410R	10	100	18	–/–	Repeater
4412G	20-30	100	19	10/1.1	Standard
4412R	20-30	100	18	–/–	Repeater
4450G	10	175	34	12/1.1	HPA
4450RE	10	175	34	–/–	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	–/–	Repeater HPA



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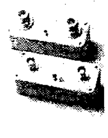
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N



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KD8JN's QRP Achievements

If you have never taught a Novice class, you're missing out on a lot of fun. When I teach a class, we have a good time. That's the way it's suppose to be, right? The class learns all about deep earth antennas, dark emitting diodes, and feedlines long enough to reach from the antenna to the radio.

Now I guess you're wondering what this has to do with QRP. Well, one of the young men in my class turned out to be one hell of a QRPer and DXer. This month we'll take a peek inside the shack of Randy Phelps KD8JN (see the Photo).

Randy works on all bands and most modes, including RTTY and packet, although not necessarily with QRP. When the HF bands are running, you'll see Randy's TNC sending to the DX cluster NODE. In the shack you'll find a Heath SB-220 ready and willing to break through the pile-up to work a new DX station if need be.

However, the DX total with just the 2 watt Argonaut 515 is very impressive. Randy has over 202 stations worked and 164 stations confirmed. The skill needed to work, using a pea-shooter, side by side with the big guns, really paid off.

Randy took first place, single op, all-band U.S.A. 8th district place in the 1989 CQ World Wide DX contest in the QRP section. He also impressed the neighbors with his first place single op phone, Ohio section, in the 1989 ARRL DX International DX contest. Not bad considering the amount of RF power used was less than that required to run the PK-232!

QRP Antennas

Randy will be the first one to admit the need for a better-than-average antenna farm when running QRP and chasing DX. Randy's antenna installation would make any ham's want list. Nope, it's not comprised of three monoband beams placed a full wavelength apart. It's a TH6 DXX tribander in a city lot. Simple wire dipoles are used for 40 and 80 meters. What makes Randy's systems click is smoothing out all the rough edges.

I've discussed these before, here in the "QRP" column. All the antenna's hardware is stainless steel. Every PL-239 has a silver plated-Teflon™ insulated center. No hamfest cheapies here! The feedline, while just coming short of nitrogen-filled 7/8" hard-line, is the best you can buy. You'll find no "barrel" connectors in any of Randy's feedlines. There is only one RF power meter/SWR bridge in his shack. And finally, everything in the antenna farm is designed to be used at the maximum legal power.

As you can see, Randy is a very active ham. I'll get a call from him during the contests asking if I have a 5Y4GT. I can't let this one go, so I tell him, "No, but I think there's one in the junk box." Next time you hear Randy on the air, ask him if he has a 5Y4GT.

Photo A. Avid DXer and QRP enthusiast Randy Phelps KD8JN at his operating position.

Expanded Voltmeter

Several months ago I had a small circuit for expanding the range of a 0–50 µA meter to read 10–15 volts. It was a simple little circuit using a 10 volt zener diode and some resistors. This month I'll show you an expanded voltmeter that works even better.

Take a look at the schematic. The voltage reference this time is nothing more than an 8 volt regulator. An LM78L08, to be precise, and a resistive voltage divider. When coupled to a 0–50 µA meter, the range will be 10–15 volts. What makes this circuit a bit better is the ability to zero the meter at exactly 10.0 volts on one end, and 15.0 volts on the other end. When using only the 10 volt zener diode, sometimes the meter would not fall to 10 volts, when in fact the battery voltage is 10 volts.

The circuit may be built on a small perfboard or PC board. Make the board small enough to mount directly to the back of the meter. Use good quality parts for the meter; they will reflect higher accuracy.

To calibrate the expanded voltmeter, adjust the 1000 ohm trimmer so that the meter reads zero with 10 volts at the input. Raise the input to 15 volts and set the 20k trimmer for full scale (15 volts); you might want to re-check the setting by running through them a second time. Be sure to use a good, high quality digital voltmeter when setting up the circuit. With a good digital meter for reference, you'll have resolution down to 0.1 volt—or better.

I used a 0–1 mA meter in place of the 0–50 µA meter. Doing this, I had to change the value of the 56k resistor in the voltage divider. I had to drop the resistor's value to 4.7k to get the meter to operate correctly. With the 0-1 mA meter, the circuit draws 27 mA from the battery you're checking.

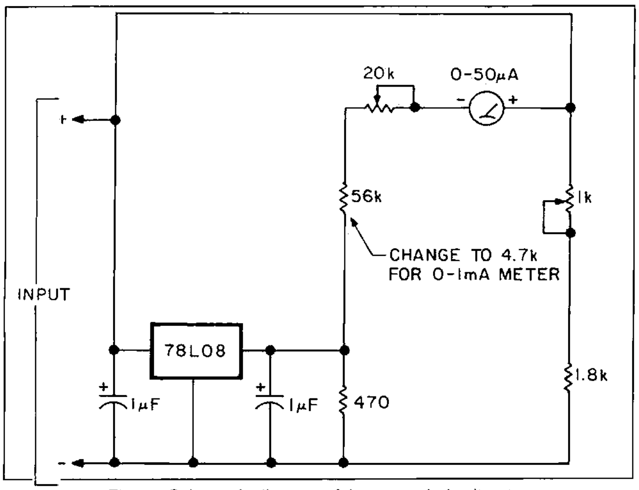

Figure. Schematic diagram of the expanded voltmeter.

That's all for this month. I still have some Pulse Charger kits left at $29.95 + $2.50 P/H. Great project to charge up those gelled lead-aid batteries for winter projects.

Getting deep into winter, home-brewing goes into full gear. Next month we'll look at Mike's Rules of Ten. 73

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Oops! It DOES Exist

How could I have been so blind? I mean, it was right there, under my nose. All I had to do was look for it! In the October 1991 "RTTY Loop" I mentioned that some amateurs were looking for interfacing for their Commodore computers on RTTY, and I said that the old Microlog stuff was great but no longer available. Was I wrong!

Thanks to Michel Ricard VE2DDT and others, my attention has been drawn to the advertisement on page 26 of the same issue of *73*. G and G Electronics of Maryland is just the answer for the amateur looking to put his or her Commodore computer onto the air.

The upshot of this is that I had a delightful conversation with Jeff Goldman, of G and G Electronics, who gave me some background on the situation. It seems that G and G was a dealer and service facility for Micrlog equipment, both companies being located in Gaithersburg, Maryland, a suburb of Washington, DC. Microlog decided to pursue other markets, and the amateur line was in danger of being orphaned. That's when G and G stepped in. With the original equipment and plans produced by Microlog, they have tooled up to continue to produce this line of amateur computer RTTY equipment.

The G and G line currently features five systems or devices, which can, among other things, put your VIC-20 or C-64 on the air as a receive-only unit, multimode transceiver, or intelligent terminal. The units are affordable, and represent quite a bang for the buck!

The Morse Coach

Here's a simple plug-in cartridge for the expansion port on a C-64 that enables a complete, computer controlled Morse teaching plan. In use by government agencies and military programs, this trainer is as useful for the individual as it is for club programs.

An "Alphabet" mode presumes no prior knowledge of Morse, and sends the characters at a minimum 10 wpm character rate, with variable spacing for the slower rates. This avoids the "dit counting" pitfall well known to instructors. (Uncle Wayne's tapes work the same way!) A "Practice" program sends a predetermined number of five character groups, with the student typing in the answers. After the run, a score is displayed. In the "Speed Test" routine, getting less than 80% correct aborts the test.

Both of these latter tests employ logic to allow for the characters to get "out of sync" by either missing a key or hitting a key twice. Lacking that, one miss could throw the entire test out of line.

Overall, the Morse Coach may be just the answer for individuals, clubs, or groups studying for a Morse code test.

The SWL Cartridge

By plugging this simple cartridge into your C-64 or C-128 expansion port, you can turn your computer into a RTTY and Morse receiver. All it needs is receiver audio, and the screen displays a real-time clock, mode and speed in use, and status indicators, along with the incoming text. Reception of five-level Baudot at 60, 66, 75, 100 and 132 wpm is supported, along with ASCII at 100 and 300 bauds, and Morse from five to 99 words per minute.

A video "cross" display is simulated for RTTY tuning and a red dot for Morse. Audio is piped through the TV speaker so that monitoring the band becomes an easy matter.

Along with the SWL Cartridge, an AIRDOS disk program is available, which allows saving the received data to disk. Printer output is provided to the standard computer printer, with either manual or keyword control. If receiving Morse or RTTY is your desire, this may be just the package.

ART-1 All-Mode Terminal

Here's a multi-mode controller that plugs into your C-64 or C-128 and provides a wide range of digital modes in a small package. The ART-1 features RTTY, ASCII, Morse, and AMTOR, in a box less than six by six inches big.

Physical connection to the C-64 or C-128 is via a cable to the user port. Radio input is via receiver audio, and transmit output may be positive voltage switching for CW and FSK, AFSK tones for microphone input, and PTT transmitter control. No power supply is required, all operating voltages being obtained from the host computer.

As with the SWL, operation on Morse at speeds up to 149 wpm, on RTTY at speeds from 60 wpm (45.45 bauds) to 132 wpm (100 bauds), and ASCII at the standard 110 and 300 bauds, is supported. Additionally, four AMTOR modes are supported: Mode A (CHIRP), Mode B (FEC), Collective/Selective Broadcast, and Listen Mode (eavesdrop Mode A).

With the same on-screen tuning cross or light, operation of this little wonder is straightforward and should provide years of flexible communication.

AIR-1 Cartridge

The preceding units were designed for the C-64 or C-128; here is one for the "lowly" VIC-20. The AIR-1 cartridge provides full RTTY, Morse, and AMTOR operation in a plug-in cartridge at a budget price.

Fitting directly into the computer's expansion port, this cartridge takes receiver audio and puts out positive and negative switched levels for RTTY and CW, plus AFSK tones for microphone keying. As with the others in the line, support for Morse to 149 wpm, Baudot from 60 wpm to 132 wpm, and ASCII at 110 or 300 bauds, is provided. AMTOR support is also available in the same four modes as the ART-1. A real-time clock, selective calling, WRU (who are you), and multiple transmit buffers make the AIR-1 a fully functional unit.

There is even a code practice routine built in, to send random five-character code groups at any programmed speed. A true RTTY demodulator is built in as well, handling the standard tone pairs of 2125/2295 Hz, with switch-selected mode or narrow shift.

AIRDISK

If you have a terminal unit and Commodore computer, the AIRDISK may be just what you're looking for. Containing the software of the AIR-1, but not the hardware, this program adds the all-mode capability of the AIR-1 to VIC-20 and C-64 computers for less than forty bucks.

As with the others, operation is on all modes, with the same spectrum as the AIR-1. On-screen tuning and software digital filtering makes operation on the bands a piece of cake. This program acts as a software interface between just about any terminal unit and your computer, allowing you to either use one you have, or experiment with new demodulator designs.

Both VIC-20 and C-64 programs are on the same disk, with the VIC-20 requiring at least 16K of RAM in the computer. For those C-64 users who do not want or have a disk, an AIR-ROM software cartridge is also available. If you have a demodulator you are happy with, this is certainly the most cost effective way to go.

Overall, we all need to thank G and G Electronics of Maryland for promoting the old Microlog line. Far too often in the amateur RTTY world we have seen wonderful equipment produced then discontinued as the manufacturer abandons the ham market. Several such units are sitting on my shelves now. Fine though they were, they were dead ends on the road of technological development. By continuing to support our market, G and G deserves our support in return. Thanks!

Next month I may have another program for the MS-DOS crowd with potent possibilities. In the meantime I look forward to hearing from you by mail or on CompuServe (ppn 75036, 2501), Delphi (username MARCWA3AJR), or now on America Online as well (screen name MarcL9). I'll tell you more about America Online in the future, too, don't worry!

Morse Coach	C-64	$ 49.95
SWL Cartridge	C-64/C-128	$ 69.95
AIRDOS	disk	$ 15.00
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All prices are list price. Shipping, handling, and tax, where applicable, are additional. Available from: G and G Electronics of Maryland, 8524 Dakota Drive, Gaithersburg MD 20877. Phone: (301) 258-7373.

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HAMS WITH CLASS

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Keys to Motivation

The theme of this month's column is *motivation*. There is probably no other factor that is more directly responsible for the success or failures we experience in life than that of motivation. It permeates and affects everything we do, but it is especially important for those of us who are teachers or instructors to understand the importance of motivation in the learning process. Someone once said, "The man who believes he can do something is probably right, and so is the man who believes he can't."

Those of us who stand in front of the classroom must never forget that the youngster or adult who is sitting before us needs a reason to be listening, a desire to learn, and a belief that he or she can master the material. All of us require motivation to master new skills and grow.

The teacher of a technical subject should be especially sensitive to the ability levels of the students, and be sure to present the curriculum in a way that is relevant to their needs.

A Quiz

Try to imagine how you would feel if a teacher were to give you just five minutes to translate and react to the following popular adages (see the answers at the end of the column):

1. Avian species of identical plumage congregate.
2. Freedom from encrustations of noxious substances is contiguous with conformity to divine prescription.
3. Pulchritude possesses solely cutaneous profundity.
4. A superannuated canine is immune to indoctrination to innovative maneuvers.
5. Ululate not over precipitated lacteal secretion.
6. All that coruscates with resplendence will not assay auriferous.
7. The existence of visible vapors from ignited carbonaceous materials confirms conflagration.
8. Mendicants are interdicted from elective recipiency.
9. Probity gratifies reflexively.
10. Inhabitants of vitreous edifices ill-advisedly catapult petrous projectiles.

If you're like most of us, you experienced frustration and anxiety while rushing in to translate the words a teacher told you to respond to. Every day, all across the country, children are sitting in classrooms feeling frustrated and anxious because they don't understand what's being said to them. It may be English that's being spoken, but it's not appropriate to the children's ages or abilities, and it's certainly not relevant to their lives.

Specific Points

Diana Ramsey, in her book *Keys to Motivation*, notes some research findings for teachers to keep in mind.

1. In order for a learner to take a risk in the learning environment, the learner must perceive that risk as being manageable.
2. The degree of risk present in a learning situation is uniquely perceived by each learner.
3. The teacher, as motivator, can create a classroom climate where risk-taking is part of the learning process. Exploration, growth, and learning result from students mastering challenges the teacher presents.
4. The #1 motivator is an opportunity for success.
5. Students learn best when they are fully involved and appropriately challenged. The teacher should initiate a rotation of challenge and success.
6. Learners must see a payoff for their efforts if motivation is to be maintained.
7. Both boredom and fear decrease student opportunities to learn. Fear and boredom are negative stresses, especially when they are sustained over a long period of time. Hence the phrases "bored to death" and "scared to death."

Dialogs with Self and Other

Positive affirmations are statements we should learn to use and encourage more often in our daily lives. They are especially important in the classroom. We all draw strength from many sources—a higher power, our parents, family, friends, and co-workers. A powerful source of strength we sometimes forget to use is our own personal power.

Positive affirmations are strong positive statements we make to others and ourselves, or hear others say. They help us tap our internal power and focus on the positive use of that power. The use of positive affirmations in the classroom can help students become self-motivated in their work efforts. It also helps build self-esteem and creates the feeling that we have power over events in our lives.

An example of a positive affirmation is, "I have all the information I need to answer these questions." It avoids the use of negative words like no, can't, don't, and won't, which tap negative energy rather than positive energy. Positive energy affirmations empower us by focusing on our strengths to manage our weaknesses.

Many successful people have revealed their ability to create a mental picture of success; this is helpful in creating a positive affirmation. Teachers who encourage the use of positive affirmations are going a long way towards ensuring that they will have a group of happy, successful, highly motivated students who are eager to come to class and will enjoy and benefit from the learning process.

Quiz Answers

1. Birds of a feather flock together.
2. Cleanliness is next to godliness.
3. Beauty is skin deep.
4. You can't teach an old dog new tricks.
5. Don't cry over spilled milk.
6. All that glitters is not gold.
7. Where there's smoke, there's fire.
8. Beggars can't be choosers.
9. Goodness is its own reward.
10. People who live in glass houses shouldn't throw stones. 73

Please send write-ups on interesting classes, recruiting ideas, youth club activities, or individual children's experiences along with photos, to Carole Perry at the above address.

Photo A. Good motivation is the key to happy, learning students. In the ham class as well as in the school classroom, be sure to provide an environment that encourages risk-taking and success.

Photo B. A good teacher makes sure every student has the opportunities for challenge and success.

and DX clubs in the USA, the JAs have organizations devoted to foxhunting.

Commercial RDF gear is plentiful and popular. Typical hand-held units for 2 meters feature a 2-element phased array beam, similar to the HB9CV array found in HF DX stations. This array is smaller than a yagi, which makes it excellent for romping through the brush.

The receiver, built into the short boom, is synthesized to cover 144 to 146 MHz. It detects both AM and FM, and is very sensitive. An S-meter and electronic attenuator are included, giving contestants the ability to estimate distance to the fox. One model features an audio S-meter in one channel of stereo headphones, and receiver audio in the other channel.

You ask, "Why aren't these state-of-the-art sets exported to the USA?" Good question—I'd like to know, too. With a slight modification, they would cover the full US 2 meter band. Perhaps US importers don't think that T-hunters here will buy enough of them to cover the high cost of FCC receiver certification. What do you think?

In addition to on-foot radio races, Japanese hams are discovering mobile T-hunts. World-class T-finder Yoshiko Yamagami JQ1LCW sent pictures of a June 1991 nighttime event. Yagis were the most popular RDF antennas (Photo C), with some ingenious methods of mounting and turning.

Yoshiko says her club holds a hunt every two months, with a two-hour time limit. It's common to see 20 to 30 vehicles competing. The Japanese are strong supporters of national and international events. The All-JA-DF competition for 1991 was held in October near Mt. Fuji. JA hams have participated in the Friendship Radio Games and the All-China RDF Contest.

Your Turn

What is your club doing about RDF, for sport or more serious purposes? Send me your T-hunt news and photos to share with "Homing In" readers. If your club's newsletter reports on T-hunting, how about putting me on the mailing list?

You say there is no hunting in your area? Well, your assignment for next month is to start one. Just talk it up and you will probably be surprised at the response.

Kevin Kelly N6QAB, an intrepid Southern California T-hunter, moved to Albuquerque some months back and found no radiosporting activity. After a bit of jawboning and demonstrating, an active hunting crew developed. You can now find a 2 meter mobile hunt there almost any weekend.

So now it's your turn. I expect a full report. ■

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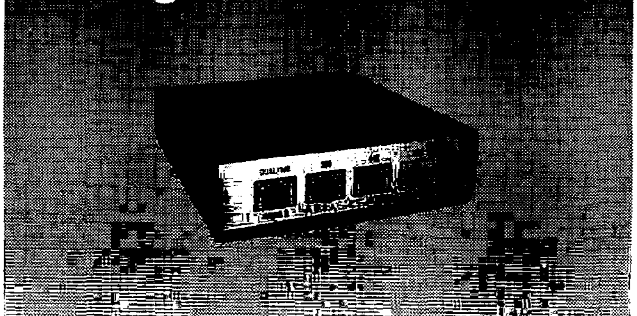

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Microwave PLL Bricks

It's the end of the year, and I'm thinking about all the projects I've done. Several of them are still in the mill for improvements, and, considering my basic personality, probably will be forever. I'm still working on the laser communications projects and improving my microwave station for 6 and 10 GHz. Recently they had to take a back seat to other items, particularly vacations and family matters which, of course, take priority.

This month we will wrap up phase-locked brick oscillators for some time, at least until a better device becomes available in surplus. The brick oscillator, in my estimation, is the best single local oscillator. It has promoted interest in microwave, as it is easy to modify to amateur frequencies by retuning the output filter. Once retuned, you have a high precision that's easy to maintain. Accuracy is something in the order of a few kHz at 10 GHz for a stand-alone unit. Long-term (a month or so) stability runs from 20 to 40 kHz.

Where do you get a brick? Check your local swap meets and flea markets. You never know when one might turn up. Keep an ear tuned for commercial stations closing down a microwave link. If you're in education, have your school write a letter to the communications authority for possible donations of material. It's worth a shot.

As to the applications the brick oscillator can fill, they are many. Use depends on what frequency brick you can obtain. If you can't locate one, I have a modest quantity of 6 and 10 GHz bricks. These include bricks without the harmonic multiplier assembly. This is the type needed for this month's project. All units I specify have been bench-tested and are functioning.

Constructing the Converter

Although the basic brick is used extensively for the 6 and 10 GHz amateur bands, I verified that it can cover other frequencies, including the 2304 MHz amateur and 1691 MHz weather satellite frequencies. While quite different in application, both frequencies present exciting new domains to explore. It is tough to locate surplus components for these frequencies. What came about was the realization that a 10 GHz brick can work on these frequencies, making it possible to more easily construct a 2304 MHz transverter and a receiver for the 1691 MHz weather satellite service.

The trick in making a converter is to come up with a simple mixer and RF amplifier. These are not difficult to obtain from standard designs published previously. The local oscillator is what stumps most people on home-construction projects. I would prefer a GaAsFET amplifier with a MGF-1402 device. The mixer is not too difficult to come up with. I designed a home-brew mixer for the 1.3 GHz bands which will also work well at 2.3 GHz. Packaged mixers, such as the Mini Circuits Labs TFM series mixers, are small and cost less than $20 each. Performance is good to 1.5 GHz, which is not bad for a mixer (TFM-5) that is so small you can hide it in a pencil eraser.

The RF amplifiers are not difficult to obtain, either. You can purchase several fully constructed devices. Several GaAsFET amps are available for home-brewing. The ARRL has published excellent designs from both Kent WA5VJB and AL WB5LUA. See Al Ward's article on designs for 2.3–10 GHz in the May 1989 issue of *QST*. Any *ARRL Handbook* from the last few years has some of Kent's GaAsFET designs for 1296 MHz. Look them up; they are what the doctor ordered, and they should be modifiable to work at 1691 MHz.

The main difference between the two converters (apart from frequency) is that the 2304 MHz converter is bi-directional. It will receive as well as transmit, with relay switching used to turn the preamplifier around for transmit. This amplifier will not deliver rock-crushing levels, but it will provide a good 10 to 15 dB gain from the mixer. See Figure 1 for block diagrams of both systems.

The Weather Receiver

The weather satellite converter output is connected directly to a 137 MHz VHF weather receiver. In the 2304 MHz version, the receive circuitry is essentially the same except for relay switching. In transmit, the transfer relay reverses the preamplifier to make it a transmit amplifier. An attenuator is switched

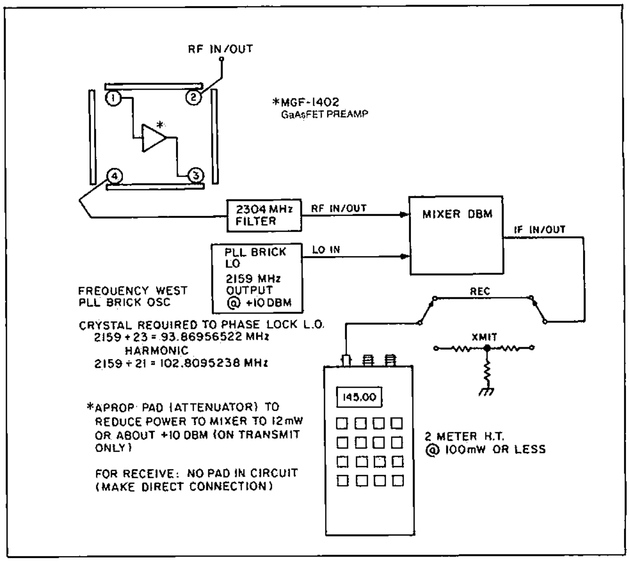


Figure 1. 2304 MHz transmit receive converter using building block method of construction.

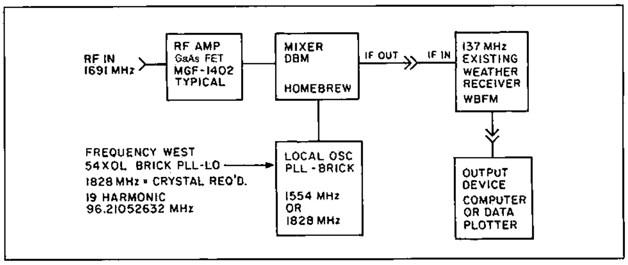


Figure 2. 1691 MHz weather receiver.

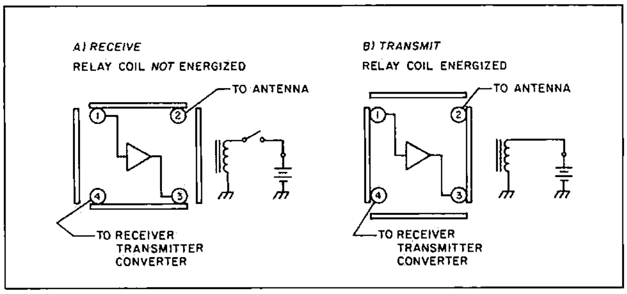


Figure 3. Coaxial transfer relay. Four-coax connector relay with the unique ability to reverse the transmission of an amplifier used non-energized for receive and energized for transmit gain.

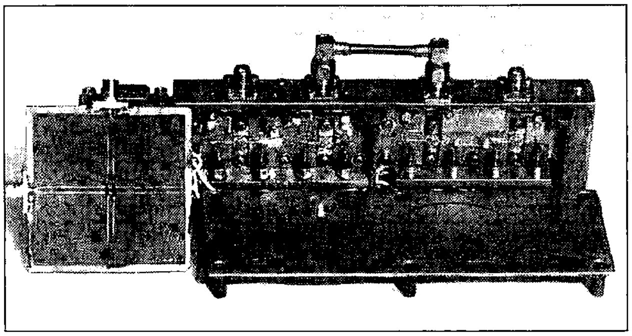


Photo A. 1691 MHz RF amplifier used in tests. This was a surplus 4-stage block amplifier with a 3 dB noise figure and 40 dB gain over 1.26–1.96 GHz. The square PC board is the home-brew mixer used for 1–2.5 GHz operation. Reference Figure 2.

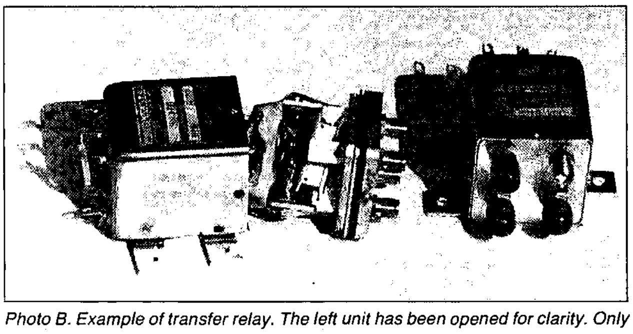


Photo B. Example of transfer relay. The left unit has been opened for clarity. Only one rocker (actuator for relay shown) transfer relay uses two rocker arms on either side of the relay coil to affect 4-port switching used for "transfer operation." See Figure 3 for details.

into the transmit path to reduce drive to a level suitable for the mixer. The maximum power needed to drive the mixer is typically +10 dBm, or about 12 milliwatts of RF. When switching is complete, the transmitter can be activated. This will produce output on 2304 MHz, FM or SSB operation.

Converters, transverters—they are all the same, no matter what frequency they are for. Usually a high frequency is heterodyned to a lower frequency for processing. The addition of filters and other switching simplify the total operation towards a one-switch operation. Timing or sequencer circuits are added to ensure proper relay operation.

Relay switching can be done manually if you choose. My station operates in the manual mode and works well. It might not be full of frills, but what's important is that it works. It just depends on how far you want to go with your project, and what you want to spend on it.

Crystal Multiplier Construction

Now comes the local oscillator. In most designs this is a crystal multiplier that needs to be constructed due to a lack of commercial equipment for 1691 and 2304 MHz. Now, I am not a lazy person, but when an easy way is available, I make use of it. This initially caused some head scratching until it became apparent that the old 10 GHz bricks are usable with minor modifications.

Last month you learned how to convert the output filter of this same brick. In this application, the filter and SRD diode multiplier are removed. Now the fundamental high power local oscillator is the LO output. I don't know why I didn't think of this before.

The operation is quite simple. The 10 GHz bricks have a high power oscillator that normally runs in the 1700 to 2000 MHz range. The 6 GHz brick's cavity oscillator runs from 1200 to 1400 MHz, making various applications possible. Take a basic 10 GHz brick (LO 1.7–2 GHz) and remove the microwave varactor multiplier and filter. This gives you direct access to the high power LO. This unit is directly under the blue label for Frequency West bricks.

Next, change the length of the cavity screw for the frequency desired. With the cavity screw seated deeper in the cavity, the frequency will be higher. Place a coaxial probe mounted on a small adapter plate over the LO high power output port. This hole was previously occupied by the varactor multiplier's RF probe. By changing the cavity length, it is then possible to make the oscillator phase-lock to frequencies as high as 2.4 GHz, making 2.159 GHz very easy to reach. This allows a 2 meter IF at 145 MHz to mix with the LO at 2159 MHz, producing 2304 MHz (or 2.304 GHz). This is the high side mix product.

For the weather satellite receiver using a system IF at 137 MHz, the LO required would be 1554 MHz (low side injection) and 1828 MHz for high side injection. I have not tried the low frequency operation at 1554 MHz, but suspect it might be possible. I am not familiar with the FM format for the weather data, but I believe high or LO side mix can work well. I am an RF person, and have never tried to receive weather data, but I will get the design worked out OK.

The crystal required for use in the brick is a high accuracy oven-controlled overtone crystal. I obtained my crystal from International Crystal Co. in Oklahoma, part number #585132 for the Frequency West brick oscillator type 54XOL. The crystals costs about $20 each. Crystal frequency can vary from 95 to 108 MHz at the frequency of oscillation. The crystals 17th to 19th harmonics are used to lock the cavity oscillator to the desired output frequency. Higher harmonics are available such as the 21st or 23rd making phase lock at 2159 MHz with a 102.8095238 MHz crystal. Using a lower harmonic would make the crystal frequency quite high and put it out of the 90 to 108 MHz range specified.

As I stated earlier, I have picked up a quantity of the 10 GHz phase-locked brick oscillators with and without the multipliers. The full 10 GHz brick with multiplier and retuned for the amateur band is $65. The basic brick without filter for the weather satellite or 2304 MHz service is $50. All prices are postpaid for U.S. destinations.

For further information on these brick oscillators, check out the many different applications covered in previous *73* articles. For temperature control and typical internal crystal oscillators, see the June and July 1990 columns. For details, including diagrams, on the 6 GHz brick, see the September 1990 column. The 10 GHz brick system was covered in the December 1989 column.

Mail Box Comments

Blair VE6AHG saw the column covering the FET Switcher (power supply) in the August 1990 issue. He has an old WWII Navy transmitter (TBW-5) he is restoring, and ran into a snag. The input power transformer is rated at 800 Hz AC input, and the switcher used to convert 12 volts DC to 110 AC is at the frequency of choice. The FET Switcher should work well. With several FETs in parallel, Blair should be able to increase current demands. The FETs are hooked up element-to-element without current equalization resistors. Use a heat sink and place transient protection from drain to ground. This transient network is a 0.1 µF capacitor and 5 ohm resistor tied in series to ground from each drain.

Jim WA9PYH saw his response for information on stripline filters in this column, and wants to say thanks for the 1296 LO PC board designed by Paul Schuch. He was going to make a copy of the artwork to try the 1296 MHz filter circuitry on the board. Jim was going to convert the filters to 1691 MHz for use with a weather satellite converter. I kind of upset his plans, as I sent a fully etched PC board with my reply. It was the same one he was going to make. Jim wrote back, "Thanks a lot! See how nice hams are. They are interested in technology and want to learn." Thanks, Jim, for the kind words.

Supplying the PC board is not only a way to answer your question, but to give your project a boost. Glad I could help out. I make my own PC boards, using the silk screen method. Once the screen is complete for a particular project, a PC board can be zipped off in no time. I have to give thanks to Paul Schuch for designing the PC board. His article for the 1296 MHz LO appeared in the December 1979 issue of *Ham Radio*.

I'll be glad to answer questions relating to the VHF/UHF microwave areas of interest. Please include an SASE. 73 Chuck WB6IGP

SPECIAL EVENTS

Number 26 on your Feedback card

Ham Doings Around the World

Listings are free of charge as space permits. Please send us your Special Event two months in advance of the issue you want it to appear in. For example, if you want it to appear in the January issue, we should receive it by October 31. Provide a clear, concise summary of the essential details about your Special Event. Check /HAMFESTS on our BBS (603-525-4438) for listings that were too late to get into publication.

DEC 1

PASADENA, CA The Toys for Tots Ham Radio Rally will be held at the world famous Rose Bowl from 11 AM–4 PM, to raise toys for underprivileged children in the Los Angeles area. All you have to do is bring a new toy valued at $5 or more to parking Lot 1, just south of the Rose Bowl. All toys will be collected by the US Marine Corp Reserves. Other scheduled events are the Ham Radio Installation Concours; ham mobile rig judging for neatness of installation, inventiveness, largest number of rigs and antennas. Judging begins at 3 PM. Talk-in on 145.180–. For info call ***Bruce N6TFS, (213) 257-5502, Packet: N6TFS @ N6YN.***

HAZEL PARK, MI The Hazel Park ARC will hold its 26th annual Swap and Shop at the Hazel Park High School from 8 AM–2 PM. Admission $3 advance or at the door. Tables $12 (reservations must be received with check, no reservations by phone!). Free parking. Talk-in on 146.64– (DART). Send table and ticket reservations to ***HPARC, PO Box 368, Hazel Park MI 48030.***

DEC 7

OOTHAN, AL The Wiregrass ARC will hold a Hamfest from 8 AM-3 PM at the Wiregrass Memorial Park. Set-up from 7–8 AM. Free admission. Tables with power $7.50; without power $5. Tailgating $2.50. Concessions available on site. ATNM and Packet Forums. VEC FCC Exams on site. Talk-in on 147.340/.940. Contact ***N4RNU, 1811 West Main St., Dothan AL 36301*** for info and reservations.

FARIBAULT, MN The annual Courage Center Handi-Ham Winter Hamfest will be held at the Eagles Club in Faribault, starting with registration at 8:30 AM. There will be a handi-ham equipment auction, VE exams, dinner at noon, and program. Talk-in on 146.19/.79 Contact ***Don Franz W0FIT, 1114 Frank Ave., Albert Lea MN 56007.***

DEC 8

LARGO, MD The Goddard ARC and the Tri-County ARC will co-sponsor Holidayfest '91 to benefit Prince George's County RACES/ARES, from 8 AM–4 PM, at the Prince George's Community College Student Union Bldg. (Exit 15A or 17A Capital Beltway). There will be symposiums on Emergency Management, Antennas, AMSAT, Packet Radio, and SKYWARN. Meteorologist Doug Hill will present a Weather symposium. Free VEC Exams will be administered by the LARC VECs throughout the day. A special CW Speed Challenge contest will also be featured. Donation $4. Unlicensed spouses and children under 12 admitted free. Tailgating (weather permitting) $5. Tables are $18 till Nov. 23rd, $22 at the door (if available). Each table includes one paid donation. Plenty of free hard surface parking. Talk-in on 147.180+, 145.73 simplex, 146.835–, 444.65+. For reservations, send payment and SASE to ***Tri-Co/Goddard Holidayfest, 360 Domer Ave., Mall-Drop 120, Laurel MD 20707. (301) 572-2326.***

DEC 14

NORFOLK, VA PC Fest Computer Shows will sponsor an event at the Norfolk Scope Convention Center from 10 AM–4 PM. Admission is $6 for adults, children under 10 admitted free. For info contact ***Shows, Inc., (407) 241-1660.***

DEC 28

GAITHERSBURG, MD PC Fest Computer Shows will host an event at the Montgomery County Fairgrounds from 10 AM–4 PM. Admission $6, children under 10 admitted free. Contact ***Shows, Inc., PO Box 832049, Delray Beach FL 33483. (407) 241-1660.***

DEC 29

SOUTH BEND, IN The Repeater Valley Hamfest Committee will hold a Hamfest Swap & Shop at Century Center, Downtown on US 33 ONEWAY North between the Society Bank Bldg. and the river in South Bend. Four lane highways to the door from all directions. Tables $5/5' round; $15/8 x 2.5' rectangular; $20/8'. Wall locations. Talk-in on 52/52, 99/39, 69/09, 34/94, 145.29. Contact ***Wayne Werts K9IXU, 1889 Riverside Dr., South Bend IN 46616,*** or phone ***(219) 233-5307.***

SPECIAL EVENT STATIONS

DEC

SYDNEY, NOVA SCOTIA The Marconi Amateur Wireless Society of Sydney, Nova Scotia, will operate Station VA1S during the month of December, 1991, to commemorate the 89th Anniversary of Marconi's first successful West to East trans-Atlantic radio transmission on Dec. 15, 1902, from Glace Bay, Nova Scotia to Poldhu, Cornwall, England. An attractive certificate suitable for framing is available to confirm contact with VA1S. Send $3 or 5 IRCs to ***Alan Leith VE1AL, 846 George St., Sydney, Nova Scotia, Canada B1P 1L9.***

DEC 1

ROSE BOWL, PASADENA, CA The Toys for Tots Ham Radio Rally will operate KA6RJF from 1900Z–2400Z on Dec. 1 to commemorate the first annual Toys for Tots Ham Radio Rally charity event. Operation will be SSB in the General 40 m and 20 m and the Novice 10 m subbands. For a certificate, send a QSL and a 9 x 12 SASE to ***KA6RJF, 1302 Mar Vista, Pasadena CA 91104.***

DEC 7–8

PEARL HARBOR, HI Region Eight, Navy-Marine Corps MARS will operate KH6SP, NNN0 and NNN0ARZ, 0400Z Dec. 7–0400Z Dec 8, from Ford Island adjacent to the Arizona Memorial, to commemorate the 50th Anniversary of the Pearl Harbor attack and the sinking of the USS Arizona. Amateur operation will be in the lower portion of the General phone bands, AMTOR and RTTY in subbands. MARS operations will be announced separately. For QSL, send your QSL card and an SASE to ***KB4JI/KH6, 106 Ford Island, Honolulu HI 96818.***

HONOLULU, HI A group of Hawaiian hams will operate a Special Event Station to commemorate the 50th Anniversary of the attack on Pearl Harbor. Operation will be 1700Z Dec. 7–1700Z Dec. 8. Frequencies: Activities are planned for all bands, all modes, including Novice subbands. Look for us at the lower portion of each subband. For a QSL certificate, please send your QSL card, 6 IRCs or equivalent, and a 9 x 12 SASE to ***Pearl Harbor Special Event, PO Box 788, Wahiawa HI 96786.***

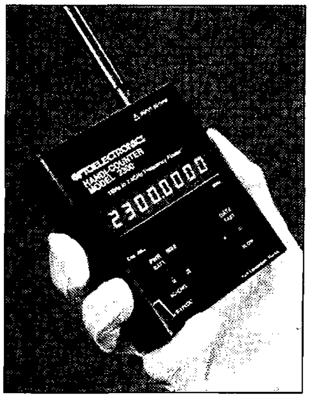
DEC 28–JAN 1

PASADENA, CA The Relay Repeater ARC will operate AA6YL from the Wrigley Mansion in Pasadena, to commemorate the 103rd Anniversary of the Tournament Of Roses; 103 years of the Rose Parade, and 78 years of the Rose Bowl Game. The station will operate from 1600Z–0400Z each day on the following frequencies: 14.260, 21.335 and 28.450. Amateurs in California/Nevada can contact the station on 2 meters via the Club repeater 144.970/147.410, on 147.21+, or on 220 meters via the Condor Connection. For certificate, send QSL and 9 x 12 SASE (58 cents) to ***Relay Repeater Club, PO Box 81, Arcadia CA 91066.***

Number 27 on your Feedback card

NEW PRODUCTS

Compiled by Hope Currier

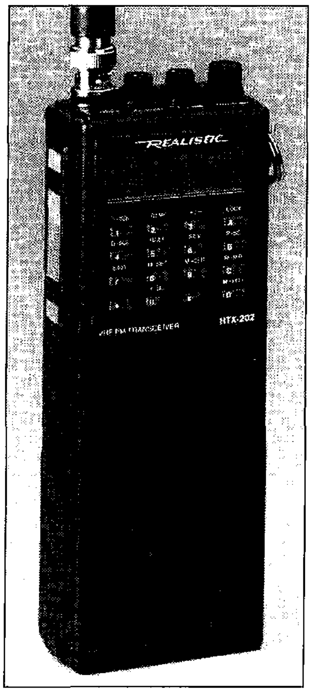


OPTOELECTRONICS

Optoelectronics Inc. has announced a new frequency detector/counter, the Handi-Counter Model 2300, for use in secure installations, countersurveillance and police tactical situations, private investigations, two-way radio, ham radio, frequency monitoring and other applications where a dedicated frequency counter is usually too costly. The Model 2300 features full eight-place readout resolution, 10 mV sensitivity for signal detection at maximum distance from the transmitter, and a unique and convenient display-hold switch so the user won't have to remember or write down the detected frequency.

The Model 2300 is priced at $99. There is an optional NiCd battery pack available for $29. For more information, contact *Optoelectronics Inc., 5821 NE 14th Avenue, Fort Lauderdale FL 33334; (305) 771-2050, (800) 327-5912, FAX: (305) 771-2052.* Or circle Reader Service No. 201.

RADIO SHACK



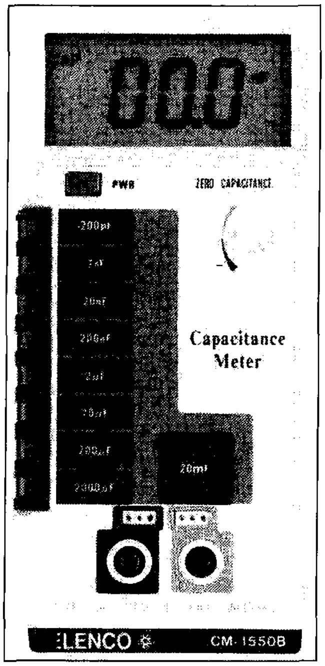
The Realistic® HTX-202 2m synthesized VHF-FM HT comes with a large-capacity NiCd battery pack/charger, a multifunction scanning system, 12 independently programmable memory channels (plus one calling and three priority memory channels), a built-in subaudible tone encoder and tone squelch, a touch-tone (DTMF) memory dialer and DTMF squelch. The highly selective receiver fights intermod and front-end overload. True FM transmit gives superior clarity on voice and outstanding performance on packet. An alkaline battery case, belt clip, charger and rubber ducky antenna are included.

The suggested retail price for the HTX-202 is $260. For the address of a local dealer, contact *Radio Shack, 700 One Tandy Center, Fort Worth TX 76102; (817) 390-3300.* Or circle Reader Service No. 202.

MILESTONE TECHNOLOGIES

CODEMASTER Version 4.0 is a new version of Milestone Technologies' Morse code training program. This upgrade incorporates changes requested by customers, especially in the area of the user interface, taking advantage of the latest compiler and processor technology. It significantly enhances user control of the program, offering a new routine for changing and saving program settings, improved performance, and a higher level of error checking.

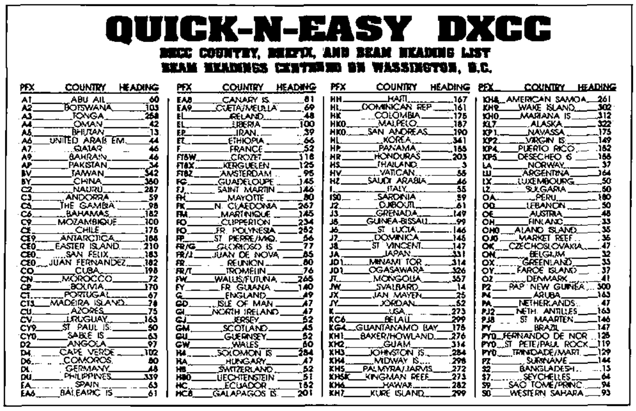
The price hasn't gone up—the new version is still $19.95. Contact *Milestone Technologies, 3551 S. Monaco Parkway, Suite 223, Denver CO 80237-1228; (303) 752-3382.* Or circle Reader Service No. 205.



ELENCO ELECTRONICS

Elenco Electronics has introduced a new series of digital hand-held multimeters that have an extra-large, easy-to-read, three-quarter LCD display, perfect for engineers, technicians or hobbyists. The CM-1500B multimeter and CM-1550B capacitance meter have a one-half percent accuracy rate. The CM-1500B measures AC/DC volts; AC/DC current to 20 amps; and resistance, transistors, diodes, capacitors to 20 µF as well as conductance. The CM-1550B measures capacitance from 0.1 pF to 20,000 µF. Both meters have side push-button switches, and the CM-1550B has a zero control.

Both meters include Elenco's two-year warranty, test leads, operator manual, and a carrying case at no additional charge. Prices are $75 for the CM-1500B, and $79.95 for the CM-1550B. For more information, contact *Elenco Electronics, Inc., 150 West Carpenter Ave., Wheeling IL 60090; (708) 541-3800, FAX: (708) 520-0085.* Or circle Reader Service No. 203.



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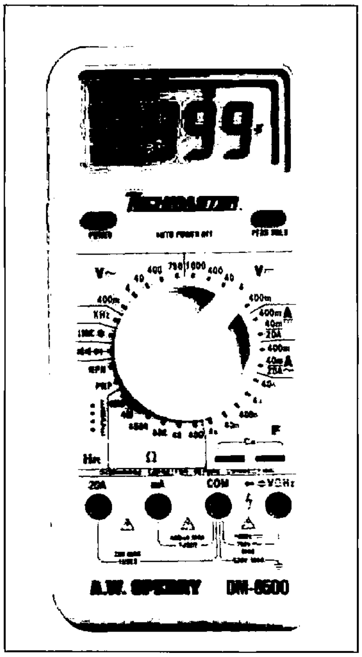
PFX	COUNTRY	HEADING	PFX	COUNTRY	HEADING	PFX	COUNTRY	HEADING	PFX	COUNTRY	HEADING
A1	ABU AIL	60	EA8	CANARY IS.	81	HH	HAITI	167	KH8	AMERICAN SAMOA	261
A2	BOTSWANA	103	EA9	CUETA/MELILLA	69	HI	DOMINICAN REP	161	KH9	WAKE ISLAND	302
A3	TONGA	258	EI	IRELAND	48	HK	COLOMBIA	175	KH0	MARIANA IS	312
A4	OMAN	42	EL	LIBERIA	100	HK0	MALPELO	187	KL7	ALASKA	322
A5	BHUTAN	13	EP	IRAN	39	HK0	SAN ANDREAS	190	KP1	NAVASSA	175
A6	UNITED ARAB EM.	44	ET	ETHIOPIA	66	HL	KOREA	341	KP2	VIRGIN IS	149
A7	QATAR	46	F	FRANCE	52	HP	PANAMA	185	KP4	PUERTO RICO	152
A9	BAHRAIN	46	FT8W	CROZET	118	HR	HONDURAS	203	KP5	DESECHEO IS	155
AP	PAKISTAN	34	FT8X	KERGUELEN	125	HS	THAILAND	3	LA	NORWAY	37
BV	TAIWAN	342	FT8Z	AMSTERDAM	96	HV	VATICAN	55	LU	ARGENTINA	164
BY	CHINA	350	FG	GUADELOUPE	145	HZ	SAUDI ARABIA	46	LX	LUXEMBOURG	50
C2	NAURU	287	FJ	SAINT MARTIN	146	I	ITALY	55	LZ	BULGARIA	50
C3	ANDORRA	59	FH	MAYOTTE	80	IS0	SARDINIA	59	OA	PERU	180
C5	THE GAMBIA	98	FK	N. CLAEDONIA	267	J2	DJIBOUTI	61	OD	LEBANON	50
C6	BAHAMAS	182	FM	MARTINIQUE	145	J3	GRENADA	149	OE	AUSTRIA	48
C9	MOZAMBIQUE	100	FO	CLIPPERTON	234	J5	GUINEA-BISSAU	99	OH	FINLAND	33
CE	CHILE	175	FO	FR. POLYNESIA	252	J6	ST LUCIA	146	OH0	ALAND ISLAND	35
CE9	ANTARCTICA	188	FP	ST PIERRE/MIQ.	56	J7	DOMINICA	145	OJ0	MARKET REEF	35
CE0	EASTER ISLAND	210	FR/G	GLORIOSO IS	77	J8	ST VINCENT	147	OK	CZECHOSLOVAKIA	47
CE0	SAN FELIX	183	FR/J	JUAN DE NOVA	85	JA	JAPAN	331	ON	BELGIUM	32
CE0	JUAN FERNANDEZ	182	FR	REUNION	80	JD1	MINAMI TOR	314	OX	GREENLAND	33
CO	CUBA	198	FR/T	TROMELIN	76	JD1	OGASAWARA	326	OY	FAROE ISLAND	37
CN	MOROCCO	72	FW	WALLIS/FUTUNA	265	JT	MONGOLIA	357	OZ	DENMARK	41
CP	BOLIVIA	170	FY	FR GUIANA	140	JW	SVALBARD	14	P2	PAP NEW GUINEA	300
CT	PORTUGAL	67	G	ENGLAND	49	JX	JAN MAYEN	25	P4	ARUBA	163
CT3	MADEIRA ISLAND	78	GD	ISLE OF MAN	47	JY	JORDAN	52	PA	NETHERLANDS	47
CU	AZORES	75	GI	NORTH IRELAND	47	K	USA	273	PJ2	NETH. ANTILLES	163
CV	URUGUAY	163	GJ	JERSEY	52	KC6	BELAU	299	PJ8	ST MAARTEN	146
CY9	ST PAUL IS	50	GM	SCOTLAND	45	KG4	GUANTANAMO BAY	178	PY	BRAZIL	147
CY0	SABLE IS	63	GU	GUERNSEY	52	KH1	BAKER/HOWLAND	276	PY0	FERNANDO DE NOR	128
D2	ANGOLA	97	GW	WALES	50	KH2	GUAM	314	PY0	ST PETE/PAUL ROCK	119
D4	CAPE VERDE	102	H4	SOLOMON IS	284	KH3	JOHNSTON IS	284	PY0	TRINIDADE/MART	129
D6	COMOROS	80	HA	HUNGARY	47	KH4	MIDWAY IS	298	PZ	SURINAME	144
DL	GERMANY	48	HB	SWITZERLAND	52	KH5	PALMYRA/JARVIS	272	S2	BANGLADESH	13
DU	PHILIPPINES	339	HB0	LIECHTENSTEIN	51	KH5K	KINGMAN REEF	273	S7	SEYCHELLES	64
EA	SPAIN	63	HC	ECUADOR	182	KH6	HAWAII	282	S9	SAO TOME/PRINC	94
EA6	BALEARIC IS	61	HC8	GALAPAGOS IS.	201	KH7	KURE ISLAND	299	S0	WESTERN SAHARA	93

FB ENTERPRISES

FBenterprises is offering a set of handy reference cards for hams. "Quick-N-Easy 2m Repeater Maps" are maps of your state, including an up-to-date list of 2m repeaters. The back of the card lists 220, 440, and 900 MHz, and 1.2 GHz repeaters in the state. These cards are easy-to-read, and great for travel. The "Quick-N-Easy DXCC" card (see photo) has a listing of all DXCC countries, along with their most common prefix, and the beam heading from your location. "Quick-N-Easy QSO Helper!" lists the RST system, Q signals, UTC time conversion, Fahrenheit-to-Celsius temperature conversion, and feet-to-meters conversion. "Quick-N-Easy Shortwave Listening" is a series of four cards for shortwave listeners. Each card shows six hours of the day with listings for shortwave broadcast stations. The "QSL Kit" is a package containing everything needed for QSLing DX stations via the bureau, including envelopes, addresses for each bureau, and instructions on how to use the bureau.

The cards retail for $4.95 each; the QSL kit is $1.99. Dealer inquiries are welcome. Contact *FBenterprises, 8818 Rainier Dr., Vancouver WA 98664; (206) 695-3637.* Or circle Reader Service No. 204.



A.W. SPERRY INSTRUMENTS

A.W. Sperry Instruments has announced a new Techmaster digital multimeter, Model DM-8500. This rugged 3-3/4 digit, drop-proof, heavy duty, autoranging DMM can read 12 functions on 37 ranges. Its many features include a fused 20A AC/DC range, overload protection on all ranges, HFE transistor test, logic indicator, peak hold, diode test, safety yellow housing and "auto-off," making the DM-8500 one of the most state-of-the-art digital multimeters available today. It comes complete with one set of test leads (TL-58), one B-4 battery, one F-20 fuse, operating instructions and a warranty card.

The Model DM-8500 is priced at $139.95. For more information, contact *A. W. Sperry Instruments Inc., 245 Marcus Boulevard, Hauppauge NY 11788; (516) 231-7050.* Or circle Reader Service No. 207.

MARCOMP

"Mr. Morse" from MARCOMP, a customized version of a package used by the Canadian Navy, is a user friendly program which uses hypertext technology, pull-down menus, windows, dialogue boxes and selection buttons. The program is divided into two modes of operation: Learning Mode for beginners, where the characters and their symbols can be displayed while transmitting; and Training Mode for continuous training for advanced users. The Receiving Module is $39.95, the Transmitting Module (added) is $24.95, both modules together are $59.95, and a kit for interfacing an actual Morse key to the user's computer is $129.95. All prices are Canadian dollars; taxes and shipping not included. Contact *MARCOMP, #402-130 Keith Road West, North Vancouver, B.C., Canada V7M 1L5; (604) 980-5718, FAX: (604) 988-6455.* Or circle Reader Service No. 206.

THE RADIO WORKS

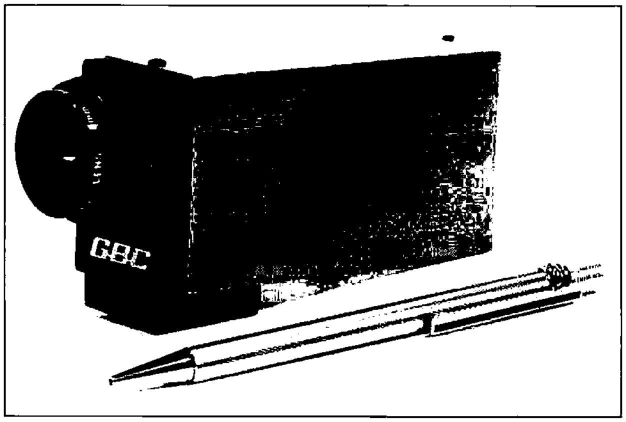
Catalog #912 from The Radio Works, an 80-page source book of wire antenna systems, parts and accessories, is now available free to *73* readers (for extra-fast delivery, send $2 for first-class postage). It includes a complete selection of coax, connectors, and antenna wire—everything for the wire antenna wire enthusiast. A full array of complete antenna systems like the Carolina Windom, "G5RV Ultra" and SuperLoop are featured. New in this issue is a line of isolators made specifically for vertical antennas, plus the 80–10m Carolina beam and the 40–10m Carolina Beam/2. Everything you need to accessorize or update your present antenna system is in this catalog, all at discount prices.

To order your copy, contact *The Radio Works, Box 6159, Portsmouth VA 23703; (804) 484-0140, FAX: (804) 483-1873.* (Mention *73*.) Or circle Reader Service No. 211.

POLYPHASER

A video tutorial, "Grounding—An Overview," is now available from Polyphaser and its distributors for $49.95. The video, approximately 60 minutes long, provides extensive information on the latest grounding techniques for communication site protection from lightning. Future videos will cover more site-selective installations, such as high-rise buildings and mountain top locations.

For more information, contact *PolyPhaser Corporation, Customer Service Department, P.O. Box 9000, Minden NV 89423-9000; (702) 782-2511, (800) 325-7170, FAX: (702) 782-4476.* Or circle Reader Service No. 208.



CCTV CORP

CCTV Corporation has introduced the "GBC" CCD-300 micro-miniature solid-state CCD camera, a vidicon camera replacement, ideal for all CCTV needs. The camera uses a unique micro-electronic shutter that allows the sensor itself to compensate for all light changes, therefore eliminating the need for an auto-iris lens. The CCD-300 can use both "C" and "CS" type lenses. It operates from low voltage (7-12V DC) and comes standard with a 120V AC to low voltage DC power module. Full video can be achieved with light levels as low as 2 lux. The camera offers resolution in excess of 350 lines, plus standard features such as adjustable gamma, auto black level, a built-in image enhancer, mirror image reversal and switchable auto/manual gain.

The CCD-300 is priced at $229.50 for *73* readers. Contact *CCTV Corp., 315 Hudson Street, New York NY 10013; (212) 989-4433, (800) 221-2240, FAX: (212) 463-9758.* Or circle Reader Service No. 210.

OWENS/BROWNING SOFTWARE

CW Simulator software from Owens/Browning Software includes Morse code training features that ham radio operators have requested: adjustable code speed and tone; beginning lesson menu; display in groups, lines and characters; "Hide and Seek" text option; letters, numbers, punctuation and Q signals; random character and callsign generator; and standard and Farnsworth modes. It has a QSO generator capable of over 700 billion combinations (users can edit and create new text); a screen editor to create, save and play back user-created QSOs and messages; a plaintext generator for three-, four- and five-letter words; and the ability to calibrate software code speed to the PC clock. The program offers on-the-air simulation, teaching the operator to copy through QRM and poor operator rhythm.

CW Simulator is available on 3.5" and 5.25" diskettes, for $24.95 each. Contact *Owens/Browning Software, 954 Church St., Hutchinson MN 55350.* Or circle Reader Service No. 209.

COYNE CO.

MacHam™ software programs from the Coyne Co. are test generator/study aids for getting a no-code Technician class ham license, and for upgrading. "MacHam Technician" contains all 700 possible FCC questions for the code-free Technician test, covering both elements 2-Novice and 3A-Technician. The MacHam programs for upgrades cover all possible questions from elements 3B-General, 4A-Advanced and 4B-Extra, respectively. Each program will generate FCC-style exams and any number of unique tests are possible. Exams can be taken on-screen or in printed form. An on-line glossary of key terms is included. Hardware requirements: any Macintosh computer, Mac Plus or newer; 2MB RAM and a hard drive; and a Macintosh-compatible printer.

The suggested retail price for MacHam Technician is $49.95; MacHam General, Advanced and Extra are $34.95 each. Prices include shipping. Contact *Coyne Co., P.O. Box 2000-200, Mission Viejo CA 92692; (714) 855-4689.* Or circle Reader Service No. 212.

Number 28 on your Feedback card

Ask Kaboom

The Tech Answer Man

Michael J. Geier KB1UM
℅ 73 Magazine
Forest Rd.
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More Gain

Before we continue our discussion of gain, I'd like to sidetrack a little and discuss a topic which may surprise you. In the three years I've been writing this column, we've covered just about every component used in modern radio gear, right? Well, there's one we've overlooked, and I was reminded of its importance by a problem I had with my TS-940.

I've had the rig for about five years, and never noticed anything wrong. Recently, though, I was fooling around with it while it was connected to my dummy load, and I discovered that the "high cut" control, which narrows the high side of the receive passband, was affecting my transmit audio as well!

The '940 has an IF monitor function which lets you listen to your actual transmit signal. Sure enough, my voice was being severely muffled in transmit whenever the high cut control was turned toward the narrow side. Even weirder, the problem only occurred when I was in LSB; in USB, the rig behaved perfectly normally! What was going on here?

Up with the Scope

Naturally, I dug out my oscilloscope and started probing. Luckily, I have the service manual for the radio, so I knew where to look. Actually, I needn't have bothered with the scope. In fact, I could have left the rig's covers on; a little deduction was all that was really required. Let's look at the facts here: Everything works fine in receive, where the control is supposed to function. It is properly locked out in transmit as long as the radio is set to USB. A look at the service manual reveals that the high cut control functions by the microprocessor's reading the position of the knob and sending data to the PLL, which then shifts an oscillator in order to shift the signal around within the SSB filter's passband. If all this stuff works, then how could it be broken only in LSB? The answer is: It isn't! The rig is shifting the PLL when it shouldn't because *the software is telling it to!*

Does Software Break?

You got it, it was defective software. Today's radios, which are virtually all microprocessor-driven, depend upon their system software to control most functions. A defect or bug in that software can make the radio seem broken, and in effect, it is. Yes, software is a component after all! Don't overlook it as a suspect, especially in obscure cases like this one, where nearly everything works and the pieces of the puzzle just don't add up.

Thanks, Guys

Kenwood was unaware of any bugs in the TS-940 operating system, but they suggested that the EPROM (which holds the software) in my rig could be defective. Although EPROMs don't fail that way (in the rare event of failure, they go completely), it occurred to me that mine could have glitched a few bytes during its factory programming. In any event, a new EPROM from the nice folks at Kenwood fixed the whole thing up. Case closed!

Gaining on Us

Let's continue our discussion of gain. We've seen what it is and why we do it. So what's the big deal, right? We know how to make amplifiers by the barrelful. But not so fast. If you've ever built an amplifier stage, you know that its gain drops off with increasing signal frequency. Audio amps are completely useless at RF. Why should that be?

The answer is: capacitance. Any time you have a voltage potential across any two circuit elements which are near each other, those two elements will exhibit capacitance along with their other properties (such as inductance, resistance, etc.). Unfortunately, this essential fact of life extends even to electrodes in a tube or layers in a semiconductor.

Thus, transistors, diodes, or any parts for that matter, have capacitance between their leads. In other words, they store charges. The result is that they have speed limits beyond which those internal capacitors cannot charge and discharge fast enough. The result is that there are numerous little low-pass filters all over the circuit. Every circuit has them. And, if you recall, the impedance of a given capacitance value goes down as the frequency goes up.

So, as the intended signals rise into the RF range, those tiny capacitances, which have little or no effect on audio signals, start to short out the RF signals you want. The result: The gain drops off until there is none left. In fact, you wind up with *less* signal at the output than you fed in! This is called negative gain, but really, it is *loss*.

Two Ways Out

There are two ways out of this situation, and each has its place. The first is obvious: Reduce the stray capacitances until they are low enough that they don't cause trouble. It works—to a point. Especially with small signal amplifiers, gain devices (transistors, ICs and tubes) are available that have been designed to have very low capacitance. They make nice RF amps up to and beyond 30 MHz.

The other solution is to make the existing capacitances part of a tuned circuit which resonates at or near the frequencies you want to amplify! Now, that same pesky property is turned to your advantage because, as you surely know, nothing works as well as a tuned circuit! This is precisely the technique used in the final amps of rigs with tube finals, and a few early transistor finals were made that way, too. Now you know where the TUNE and LOAD controls came from—they set the resonant circuit to the frequency you are trying to amplify.

It is possible to make no-tune RF amps. Most solid-state rigs have them, and some tube linear amps use them also. Basically, they are broadband tuned circuits. I know that sounds like an oxymoron, but it can be done. You just use a very low-Q LC (inductive-capacitive) combination with no distinct resonant peaks within the desired passband. As long as you cancel the circuit's internal capacitance with sufficient inductance, it works. In practice, it's a bit harder to do well than it sounds.

More Than Amps

Last month, at the beginning of this exploration, I stated that gain was the foundation for virtually all electronics. We've examined amplifiers, but it takes more than amplifiers to make radios, computers, TVs, etc. Let's look at how gain can be turned to other uses.

You know how placing a microphone too close to a PA speaker causes feedback howl? Well, that's exactly how oscillators work. They're just amplifiers which "hear" their own signals, causing the signal to go around and around. The speed of travel is limited by circuit capacitance, and by deliberate means such as coil-cap, resistor-cap, or crystal resonant circuit elements. If a voltage-tunable capacitor (called a varicap or varactor diode) is used, you've got a VCO (Voltage Controlled Oscillator), which is an important part of most frequency synthesizer schemes.

In order for the oscillator to work, the direction or "phase," of the output must be the same as the input. That's called noninverting gain. When the phase is opposite—when the output goes down as the input goes up, and vice versa—you have inverting gain. An inverted signal cannot reinforce itself at the input, so there can be no perpetuation of the signal. It's a useful technique when you want to *avoid* oscillation in a circuit meant only to amplify.

Open the Gate

Digital gates, from which all computers are built, are amplifiers, too! The foundation of the binary digital technique is that there are only two circuit states: on and off. So, these amplifiers are deliberately designed to have extremely poor linearity! They are always either driven all the way on, or they are off. Actually, the internal construction of a typical digital gate looks remarkably like that of an audio amplifier. Inverting amplifiers are used for inverting functions like inverters, NAND and NOR gates. Noninverting amps are used for AND and OR gates, as well as buffers. By the way, an entire computer can be built from NAND or NOR gates. But it would take an awful lot of them to build a PC clone!

Now, let's look at some letters:

Dear Kaboom,

I have an ICOM 575H 6 and 10 meter radio, and I need an antenna tuner for it. Daiwa makes one, but they only sell it in Europe. Any ideas?

Signed, Out of Tune

Dear Out,

An antenna tuner is a very simple thing. Really, it is just a coil and few variable capacitors. The first thing I'd try is to borrow a small tuner from a friend and try it, even if it isn't made to cover 6 meters. Start with the inductor set for minimum inductance and give it a try, keeping the rig set for low power while tuning the capacitors. The tuner's SWR meter will probably be a bit inaccurate at the higher frequencies, but it should still suffice for relative indications, which is all you need anyway. I'd stay away from big, kilowatt tuners here, because their larger components are likely to have too much stray reactance to work well at 50 MHz. If you can't get it to work, why not build your own tuner? Check the ARRL *Handbook* and other antenna project books for plans. Lots of hams build their own tuners, and you can, too!

Dear Kaboom,

Sometime back you mentioned the KDK FM-2016A 2 meter mobile. I have one with a problem. The transmit frequency is off by 3 kHz on the high side. I've tried adjusting the oscillator trimmer and also the three offset caps, but no luck. What can I do?

Signed, Off and Tired of It

Dear Off,

Yeah, mine's had that problem, too. You need a new crystal, which you can get for a few bucks from any of the crystal houses advertising in the backs of the magazines. If the frequency is off only in the + shift position, replace X2, which is the 13.966 MHz crystal. After you replace it, be sure to set the trimcap for the correct frequency and also to readjust the trimpot next to it by setting the +5 kHz switch on and turning the pot for the correct frequency.

73, and see you all next month. 73

Never Say Die

Continued from page 4

often exciting. And beating down the pile-ups, hour after hour, is a rush you'll never forget the rest of your life. What does it take to blast you away from the boob tube and your nightly net? Or are you investing the few hours left of your life numbly watching quiz shows, sitcoms and soaps, drinking beer and eating potato chips? Oh, I see those flabby beer bellies hanging out from under your dirty tee shirts and over your belts at hamfests.

Albania was one of the last bastions. One of the rarest of the rare. I forget now how long ago it was that Frank DL7FT/ZA got on the air for a few hours. . . yes, of course I worked him. I think he got permission from a minor official and it took a while for higher officials to overrule the decision and escort Frank back over the border.

But you don't have to go for the #1 needed country. If you just go down to the Caribbean you can find some fairly rare islands which'll guarantee you pile-ups. Visiting these are more a matter of your doing some research and having the initiative. No dangers involved. No pioneering. But one heck of a lot of fun. And if you take some pictures you might get published in *73* by a jealous editor. A very jealous editor.

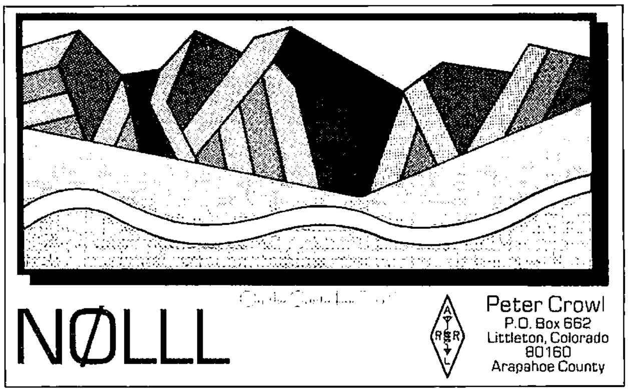
It's been a couple years since I got on from W2NSD/FP8, so I need a DXpedition fix. I'm definitely antsy. I've got my pictures out from my 7P8 and 3D6 trip. . . sigh. Then I've been invited on a diving trip for next March to New Caledonia. I haven't operated from there in years. I haven't even kept in touch with all my ham friends in Noumea.

What'll it take to get you off dead center and into action? Don't you get excited thinking about it? I suppose I should tell you about when I got on from Nairobi, Beirut, Damascus, the American embassy in Tehran, Kabul, Katmandu, and so on to get your fires warmed up.

I guarantee I'm busier than you, but that doesn't mean I wouldn't drop everything in a minute and head to Albania. The readers who responded to my September editorial asking for help setting up a national rep organization to sell music and music publications will get an idea of the number of projects I've got going. It's such a network of interrelated projects that I think there are only one or two people working for me who understand how it all fits together.

I do my letterhead on my laptop computer because the number of my companies changes every few days. Of course I suppose I come across as a Great Panjandrum as a result. Put it down to the Wizard of Oz syndrome. But yes, I'm busy. Of course, since I retired in 1983 I've been just having fun and I rarely spend much more than half a day "working". . . 12 to 16 hours, tops. Okay, so where shall we go and raise some hell on the bands?

Let's not forget to take along SSTV. I had it with me at KC4DX, JY9AA and 7P8PA. We'll need packet and OSCAR gear. RTTY? Why not? I had a great time on RTTY from Bangkok not long ago. Are you packed yet? Burma seems to be opening up. When I visited there was no hamming. Ditto when I visited Baghdad, but I'll bet King Hussein could put in a bad word for me and YI2NSD might be able to hit the ground running. Or should I start another magazine instead? I've got this *Secret Guide to FREE Music* I want to get going. . .



QSL of the Month To enter your QSL, mail it in an envelope to *73*, WGE Center, Forest Road, Hancock, NH 03449. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

The Magic of Communications

Until you are robbed of both the visual and audio cues we're used to getting while talking, you don't realize how important these things are for communications. This, more than anything else, is what causes mike fright. Suddenly we have to talk to someone and we're not getting the cues we've been used to getting all our life. No nods, no eyes to see, not even any uh-huhs to keep us going.

It's no wonder so many of us tend to get into habit patterns, saying essentially the same thing for one contact after another. . . day after day, year after year. What can we talk about? We call a CQ, get a call from someone who gives us nothing more than a callsign. So we have to start off with the basics. . . name, location and signal report. Then we feel we should say something else. . . like what? We don't even know his name yet. So how can we get any kind of a conversation going? The weather? Good grief! How about your rig and antenna? You know he doesn't care any more about that than you do, so why waste your breath?

It's embarrassing to start reading off a list of your interests, so that's out. In a couple of years I hope we'll have a way to send such a list, perhaps via packet or a sub-carrier, so it can be displayed on the screen on the other chap's rig. Better yet, a fairly simple processor in your rig could match your interests against his and highlight them on your screen.

Meanwhile, how are we going to get a real QSO started? Maybe this is insurmountable and we should just forget even trying to use amateur radio for meaningful communications. Perhaps we should just give up and use it for contests, DXing (which is a form of contest) and checking into nets where we've already known everyone for a long time.

Duplex

It's a shame that we didn't at least build our repeater systems so they'd work full duplex. Back before the FCC changed the rules, I used to love working duplex on 160m with four to eight stations all sitting there talking, just as we would in a living room. I think it was January 1938 they made that illegal. Oh, they didn't intend to. . . that was a by-product of their wanting to stop a handful of jerks who were broadcasting records for hours at a time. Yes, we've always had a good supply of jerks.

So the FCC dumped a rule on us which said all transmissions had to be for the purposes of communications. That scotched the records all right, but it also had the FCC monitors sending out pink QSLs for duplex contacts.

We could get back to duplex on our repeaters if we'd use two-band rigs. Then two of us could transmit on two 146 MHz channels and listen on 222 or 450 MHz. Anyone want to give it a try and write about it?

It would be much more difficult to do this on the HF bands, but if you separated your antennas a bit, you could work duplex from one end of 10m to the other. . . and probably 15m too.

I used to have a ball getting some fairly rare DX stations into a 75m net via my 20m station. I'd relay the 75m net on 20m for the DX station and then relay the DX station from 20m to 75 so he could talk to the net. It worked great and was exciting.

I got an FCC monitoring complaint about it once, but they backed down when I explained that (a) all my transmissions were for the purposes of communications and (b) I'd checked with the FCC in Washington before I did it.

As long as you've got at least two stations on one band you can legally work duplex orossband. A devious person might set up a duplex operation with another station and give the call of a fictitious third station just to give the facade of propriety.

But what about QRM, I hear you grumbling? Sure, that's a problem, but not an insurmountable one. Ten meters is essentially dead for many hours a day, so you wouldn't be likely to get much interference if you you used it for ground wave contacts. Fifteen meters will be dead more and more of the time as the sun spots fade again. Then there's poor old six meters, which has almost been abandoned.

It doesn't take a lot of ingenuity to set up a remote station on, say, 20m. It only has to be far enough away so your receiver doesn't block. I used to have my 20m station linked via a 2m repeater so I could operate it from anywhere around town via a 2m HT. That worked out fine, allowing me to make DX contacts while getting my morning exercise, climbing Pack Monadnock Mountain.

So let's use some imagination and get more fun into hamming. If you can start a movement toward duplex operation, you may be able to help us break the boredom barrier. Let me know how you make out. And let me know if duplex operating doesn't bring excitement and fun to your hamming.

Bad Mouthing the League

I got a letter last month griping that "I'm always bad mouthing the League." Let's mull that one over. Bad-printing would be a more accurate term for the perception.

When I get a letter like that I know two things. I know that the writer is (a) not a thinking person and (b) has a religious affiliation with the ARRL, not a rational one. Let me explain the situation.

As the dominant publisher in the ham field, the ARRL has, to my mind, a responsibility to do its best to keep the hobby healthy and make it grow. It's the League's failure at these two basic responsibilities which I deplore. . . and which I often comment on, offering constructive criticism.

In the music field my magazine, *CD Review/Music & Audio Reviews*, is as dominant as *QST* is in amateur radio, so I feel a responsibility as the publisher to help the music industry be healthy and grow.

When I was publishing computer magazines I accepted the responsibility that came with my dominance in that field and helped the field to grow with books, the first mass-produced software, a computer show in Boston and so on. None of these were big moneymakers, but I felt they were important for the growth of the industry.

In the music field the industry has been taken over by a cartel of six international megacorporations (mostly foreign owned) that now control over 95% of all music sales in America! That doesn't seem healthy to me, so I'm working to bring about some changes . . . as I mentioned in September. The music business is big enough so even 5% of it is significant, running to around $400 million a year in sales. My goal is to build that to maybe $4 billion.

In September I asked for hams inter-

ested in making some spare change as reps for my distribution company, Creative Music Marketing. We've already got a nice stack of applications, so we're in business.

Reps will help get my magazines, plus about eight other music magazines, which we also distribute, into record, music instrument, book, and hi-fi stores. They'll help us distribute music from several hundred independent record companies. They'll help distribute our "Adventures In Music" sampler CDs. They'll help get new releases played on local radio stations and reviews in local papers. It's a fantastic business for anyone who loves music, and should eventually pay off very well.

Just as I'm helping the music industry to grow and to clean up some of the dirtier aspects of the business. . .such as the radio payola which was recently documented by the best seller *Hit Men*, and a sorry lot of crooked distributors. . .I believe the ARRL directors should be working with every tool at their disposal to help us clean up the messes we have on our bands. I also believe they should make it their business to get the growth of amateur radio back to where it was before the League stopped it dead in 1964.

Yes, the no-code license, which the ARRL fought for years, has increased our growth, but it's still far short of the steady 11% growth we had in the 1945–1964 period. The League, if the directors wanted, could turn this situation around in a year. I've outlined what needs to be done many times. . . known as "League-bashing."

There was a wonderful article in the September issue of *Success* magazine on goal setting. "Every successful person is an obsessive goal setter." The article pointed to a study made of the 1953 Yale graduating class. They were asked (a) Have you any goals? (b) Have you written them down? (c) Do you have a plan for accomplishing them? Only 3% answered yes to all three questions. Twenty years later the group was surveyed again. The 3% who'd said yes were more happily married, more successful and had better health. . .and 97% of the net worth of the class of '53 was in the hands of that 3%. It's almost enough to make a person think.

Says *Success*: "You can go through life, or you can design one. If you have a plan, if you have a goal, then opportunities pop out in front of you. Most people spend more time planning their vacation than they do their life."

It also points out that, "Doing anything for money is instant failure," and "Studies show that 58% of Americans never read a non-fiction book once they finish school. . .the average person listed in *Who's Who* reads 20 books a year. . .now tell me who has the better chance at being successful?"

I've got all kinds of opportunities to use my guerrilla marketing approach in the music business because the six majors are run by financial guys, not music guys. The music industry is much like a third world country with a few very rich people and the rest in abject poverty. Of such conditions revolutions are made. . .and I'm starting one.

My *IMPS Journal* is read by 5,000 independent music producers. My *Music Retailing* is read by about 5,000 independent record store owners. These are the only publications reaching these groups regularly, so they give me an enormous advantage in mounting my guerrilla attacks.

If the ARRL directors would set up some goals. . .and then honor them . . .our hobby would benefit endlessly. They did set up a goal a while back to promote the hobby and bring about substantial growth. Then they did almost nothing to make it happen. How much credit should they take for the current spurt in growth? I've seen letters from Newington taking full credit for the no-code license. Before any HQ arms get broken with self-congratulation, there should be some admission that we'd have had no-code at least 10 years earlier if the ARRL hadn't fought it with every trick in the book. The League reluctantly endorsed the idea once there was no further way to stop it.

League old-timers are still griping to anyone who will listen. . .and not many will. . .that the no-coders will ruin the hobby. They're nothing but dumb CBers, they claim. These old turkeys stopped reading *73* years ago. . .if they ever did. . .so they don't know (and don't want to know) that the new no-code licensees are turning out to be some of our best operators. They don't know. . .and don't want to hear about it. . .that the newcomers are, almost to a person, getting busy learning the code so they can upgrade. Closed minds ward off such data.

As my grandmother used to say, "A man convinced against his will is of the same opinion still." Max Planck, who ran into the same problem with his quantum theory, said essentially the same thing. Some old-time scientists are still fighting quantum theory.

I keep Max's quote on my office wall. "A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die and a new generation grows up that is familiar with it." Keep that in mind as those doddering old-timers grouse about no-code at club meetings. They're old, so you'll be seeing them in Silent Keys ere long.

Of course, with the average ham age in the mid-50s these days, most of us are headed toward pulling the big switch. You can react to that news by giving up and making everyone around you as miserable as possible while you await your final blessing from the ARRL. Or you can say, hey, I've got to get moving and get some things done that need doing. . .set some goals and pursue them.

If helping to clean up amateur radio and get it growing by ousting the old guard ARRL directors doesn't appeal to you. . .and if you aren't particularly interested in helping me clean up the music industry and open it up for entrepreneurs. . .perhaps you can get your teeth into something else where you'll make a difference.

I'm active in the education field and I'm already making a small difference. The governor (NH) appointed me to the new Economic Development Commission to try and get New Hampshire back in the black. I've got some plans for helping our largest industry, tourism, grow. . .with a goal of doubling in the next three years. And I've got some educational plans which should bear fruit in about 10 years, attracting high tech entrepreneurs to the state.

If I can improve New Hampshire tourism, you can bet other states will soon follow suit. Ditto education. This is a perfect state for things like this in that it's small enough so it's easy to know the governor and other key players. . .like the richest guy in the state, who is also a good friend and supporter.

New Hampshire has always been progressive. We had the first aerial tramway in North America (1938). We had the first lottery. We've had two governors who became presidential advisors.

The current unemployment in NH has mostly to do with the high concentration of larger high tech businesses such as DEC, Data General, Wang and so on. Too much bet on fading technologies. . .too much on defense contracting. New Hampshire needs to actively attract small high tech entrepreneurial businesses if it wants to avoid future recessions.

Once the large companies falter they start laying off thousands of workers. This has a domino effect on construction, home prices, car sales and so on. It depresses everything. Entrepreneurs, on the other hand, are able to quickly adapt to changing technologies and ride each succeeding wave. It's far easier to be in front of a trend than to try and catch up later.

The microcomputer is making both the mainframe and the minicomputer obsolete. Anyone but the accountants running the big companies saw this coming years ago. Indeed, I wrote about that in my editorials 15 years ago, explaining exactly what I expected would happen. . .and it has.

What do I see ahead in the ham field? Either we accept the responsibility and force the ARRL to do what its charter says it should, or we're dead meat. We all know in our hearts that technology is rapidly making amateur radio a pathetic relic of the past. Sure, CW is fun. So is DXing. But do we really believe that we're going to be able to hold onto hundreds of billions of dollars of radio spectrum for the amusement of an aging group of old men? Old *white* men?

We either bring in youngsters by the hundreds of thousands and encourage them to experiment with new communications modes or we're goners, but just don't know it yet. Bill Hoisington was busy experimenting with new modes until he died in his 80s. He was at that since I first met him as W2BAV in 1948. Age is no excuse for vegetating.

Old-time readers will remember Bill's dozens of articles in *73* on building microwave transmitters and receivers using simple, inexpensive transistors and test equipment.

Ham Broadcast Service Coordination

Just as repeaters started sprouting throughout the VHF bands 20 years ago, we are seeing a ham broadcasting service starting to spread through our HF bands. And just as we found it critically important to set up voluntary repeater coordination to limit interference, perhaps it's time for coordination to help keep our ham broadcasting services from interfering with each other.

Some Basic Rules

Since the FCC has provided no real guidelines for this service, I'm going to propose some which seem reasonable to me. If you disagree, please let me know what you suggest as an alternative.

For instance, since it's so simple to set up a ham broadcasting service using a tape recorder that almost any ham can do it, I propose we agree up front to try to keep news broadcasts under one hour in the interests of spectrum conservation.

Of course our role model for ham broadcasting should be W1AW, which has been doing this with great success for decades. Few of us can hope to equal their incredible (and horrendously expensive) array of Harris commercial broadcasting equipment, but their computer control, which allows the station to be run with no operator present, can be easily emulated. Indeed, articles on software for this application will certainly be of interest.

In order to keep interference minimal, I suggest we plan to give broadcasters 10 kHz channels. Since K1MAN has claimed 14.275 kHz for his own on 20m, we can allocate from there on down the band, stopping at 14.225, which would give us seven channels. Once those have been allocated we might want to continue on up to 14.325, giving us five more channels. This could be a great solution to KV4FZ's continuing 14.313 garbage heap.

Once those 12 channels have all been coordinated, we'll need to consider a time-sharing system, with perhaps some transmitting on the even hours and the alternates on the odd hours.

But What About QRM?

First, the FCC regulations say clearly that it's necessary to check a frequency before transmitting on their self-assigned (commandeered) frequencies, whether anyone else happens to already be using them or not. Many nets operate on the same principle. . .that they are the primary users of the frequency and have an inherent right to them.

Once we have enough broadcasters in operation, most hams will probably be so busy listening to these interesting broadcasts that they will have little need to transmit, anyway. Thus, each ham broadcaster could easily keep hundreds or even thousands of other ham operators busy listening, thus reducing QRM significantly.

Material To Broadcast

The FCC regulations state that ham broadcasters must transmit information of particular interest to amateurs. This could include discussions of proposed rule changes. It could include technical discussions. It could include theory lectures and code practice to help amateurs upgrade their license grades. It could include DX and DXpedition information and lists of QSL handlers.

In fact, almost anything can be discussed, as long as even a remote connection is made to amateur radio. I'm looking forward to making tapes discussing in detail every one of my DXpeditions over the last 33 years. And for those of you with color slow-scan equipment, I'll have some nice color pictures of the DX stations and rare countries I've visited. I've got thousands of fabulous pictures.

There's no reason bulletins have to be all on voice, CW or SSTV, so I'm sure we'll be seeing RTTY, ASCII, and other computer-readable formats turning up.

Just as we have hundreds of ham nets, I'll bet we'll have special interest ham broadcasting. . .for ham doctors, lawyers, submarine vets, G.E. employees and ex-employees, UFOs, MAC users, PCers, and so on.

I hope we don't run into the problem we have with repeaters where we've almost reached a 1:1 ratio. . .one ham for each repeater. This at least has the benefit of keeping our VHF bands almost totally silent, other than for random automatic repeater identifications. The up side is that once we saturate our bands with ham broadcasters, we'll have less of a need for coordination, since everyone will be transmitting and almost no one listening.

Quality Counts

If you've been listening to the W1AW and K1MAN daily broadcasts, you already know many ways you can substantially improve on the services they are providing. For instance, you certainly don't want your broadcasts to be as deadly pontifical and humorless as those from W1AW. And please try to avoid those self-promotions and egregious ego-gratifications which characterize K1MAN's endless tirades.

You want your material to be interesting, amusing, and helpful to your listeners. After all, you're in the world of broadcast radio now and you win or lose your listeners not so much on the information content of your broadcasts as on their presentation. You're in show biz. Non-profit show biz, to be sure. . . much like our public radio systems such as NPR, APR and college radio stations. This means you'll build your listening audience more on your interpretation or slant on the news than on the news itself.

Data Services

With computers so ubiquitous, there's no reason not to include data transmissions at the end of voice broadcasts. I've suggested including slow-scan video so you can include illustrations. . .such as pictures of hams who have done something outstanding (good or bad) and their stations. You might show QSL cards from rare DX stations.

For greater illustrative detail, you'll want to go to desktop publishing technology and scan in things like schematics or magazine pages and send them as data. Music, too, can be sent as data, using the standard compact disc encoding format. Yes, you can legally transmit music this way!

Then there are items such as lists of hamfests, auctions, and other such club activities, contest schedules, rules and results from the hundreds of contests and awards around the world, data and comments on pending rule changes, even complete scanned-in club newsletters and foreign ham magazines. Wait'll you see some of the marvelous construction articles appearing in the Japanese magazines! The FCC's recent hints that it may no longer object to us selling ham gear over the air could open a whole new broadcasting and data arena.

Simultaneous Broadcasting

Ham broadcasters will want to emulate W1AW and K1MAN by developing their services to cover several amateur bands at once. This means buying more transmitters, but that's just more business for our ham industry. If hundreds or even thousands of ham broadcasters buy eight or 10 transmitters each, it'll do wonders to improve the ham industry economy. I don't recall any rules against transmitting on several frequencies in one band at the same time.

Paid Operators

Obviously a strong ham broadcast service will be more than can be accomplished with all volunteer operators. Ham broadcasters will have to operate seven days a week and at least around 12 hours a day. This is going to mean paid operators. Fortunately for us W1AW has set a precedent which, though it was patently illegal, has been accepted by the FCC for many years. It's legal to pay ham operators to broadcast. You can also pay them to write the material, record it and transmit it.

Unfortunately, that brings up something none of us want to talk about or admit to even obliquely. . . how to bring in the money it takes to pay a staff. Well, one way is to set up some sort of national or even international ham organizations and charge a membership fee.

Another might be to work a deal to innocently weave product mentions into your broadcasts. For instance, you might comment at length about how this or that famous DXer is awfully fond of drinking an ice cold, refreshing Coke when the going gets rough. Or that a ham luminary who will be giving a talk at the such and such ham club will be staying at the local Embassy Suites hotel, where they serve fantastically delicious breakfasts at no extra charge and have TV sets in both the living room and bedroom of their surprisingly inexpensive suites.

I'm sure our legendary ham ingenuity will find a way to circumvent what's left of our tattered regulations.

Special Interest

I suspect that many of the early ham broadcasters may, like K1MAN, be driven by emotional considerations more than by public service, so we'll probably be hearing ham broadcasters with special interests holding forth and slanting their material to support things like homosexuality, women's rights, women's choice, anti-abortion, rain forest preservation, tree hugging, baby seal protection, dolphin saving, education bashing, Christianity, Mormonism, Islam, world peace, famine relief, Libertarianism, and so on.

But, you expostulate, some of these things are pretty far afield from amateur radio. Is not to worry. . . that aspect of ham broadcasting has already been pioneered by W1AW. Far's I know, the FCC has never in all these years cited W1AW for addressing their broadcasting to non-amateurs. And what else would you call their code practice transmissions?

In my day, over 50 years ago, they were sending code practice at 13 wpm to help non-licensed listeners pass their first license tests. When the code speed was dropped to five per they lowered their practice speed. These transmissions clearly were not addressed to license amateurs. Thus we have at least a 50-year acceptance by the FCC of using our amateur bands for broadcasting to non-amateurs. I'd say that's a pretty clear-cut precedent.

Frequencies

With K1MAN tying up 3975, 14275 and 28475 six times a day (0745, 1100, 1300, 1700, 2100, and 0000 UTC) for 45 minutes at a time, newcomer broadcasters are going to have to go some to get ahead of Baxter. He even goes on AM on Sundays on 3890 and 7290 at 2300Z.

I like the idea of high fidelity AM transmissions. Yes, they sure do fill up a 10 kHz channel, but they're much easier for SWLs to tune in, possibly attracting new hams to our hobby from the listener ranks, since most inexpensive shortwave receivers aren't equipped to handle SSB.

Coordination

I will be glad to list ham broadcasting service stations, along with their frequencies and times, plus any special interests they may cover. Once listed in *73* they may then announce themselves as "Amateur Radio Official Broadcast Stations" (AROBS).

Am I Serious?

Yes, of course I am. . .this is a serious test to your credulity. . .just as the K1MAN transmissions are a test of your ability to put up with a massive waste of our frequencies and patience. 73

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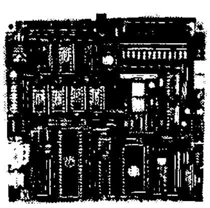

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RANDOM OUTPUT

David Cassidy N1GPH

It being December (even though I'm writing this in October), I wanted to write a quaint holiday story—maybe something about all those repeater groups who bring Santa Claus to kids in hospitals, or a tender and touching story from my childhood. I'm sorry, but I can't do that. There are a few things going on in our hobby right now that are too important to wait until January.

The Haller Hustle

FCC Private Radio Bureau Chief Ralph Haller (N4RH) announced at an FCC Forum held during the ARRL National Convention that the FCC is considering a rewrite of Rule 97.113. This is the rule that tells us what we can't transmit over amateur frequencies—business communications, messages for hire, broadcasting, music, etc. In a nutshell, what Haller proposes is to allow certain types of business communications on the ham bands. This would include such activities as coordinating public events and providing information for the news media, as well as personal business like ordering a pizza over a phone patch.

Haller stressed that this new "third type" of amateur communications (the first two being emergency communications and "all other" permitted communications) would be on a secondary usage basis, utilizing "unused Amateur Service frequencies."

This proposal scares me, and it ought to frighten you, too.

By accepting Haller's premise, we are agreeing with him that there is an excess of "unused Amateur Service frequencies." Do you really want to stand up in front of the FCC and say, "We have plenty of unused frequencies, and I'd sure like to help out my local TV station by providing a free business band."? You and I both know that once you allow use of amateur frequencies for business purposes, it is only a matter of time before those frequencies become full-time business frequencies. As soon as you make the amateur service a business service, you can kiss it good-bye. . . and this is exactly what Haller is trying to sneak by us.

The problem with a suggestion like this is that it SOUNDS great. To be sure, there are some communications services that currently fall under the gray area of "business" that might benefit both amateur radio and the recipients of those services. A club offering communications services to local non-profit groups (which hams have been doing for decades, anyway) would be a great PR tool for amateur radio. But ordering a pizza over a phone patch? Is that what amateur radio is all about? Don't be fooled by phrases like "secondary use" or "utilize unused Amateur Service frequencies." This is a smoke screen, set up to hide the fact that business interests in this country desperately want our spectrum. Every scenario of a business use suggested by Haller already has a radio service that can take care of it. The only thing that Haller's suggestion will do is allow businesses to get free communications services, with the amateur band equipment costing thousands less than comparable business band equipment.

Now that the subject has been raised, it is inevitable that we will have some sort of change to the "no business" rule. I suggest that we all take a very hard and long look at whatever is proposed. I urge you to send a very definite message to the FCC. Tell them, especially Private Radio Bureau Chief Ralph Haller, that you see right through this charade. Tell them that you do not believe there is such a thing as "unused Amateur Service frequencies." Tell them that the Amateur Radio Service must keep itself clear of any association with business communications.

If the proposed changes are in the interest and for the benefit of amateur radio. . . fine. But let them know that we are watching their every move to see exactly what is going to come out of all this.

You might want to mention that you are also well aware of PR Docket 91-170. Oh, you mean you don't know about PR 91-170? Please, allow me to enlighten you. PR 91-170 is a move, initiated by Mr. Haller's group, which could revise the land/mobile frequency spectrum in order to make room for new and developing technologies. How coincidental that Haller now suggests that perhaps business communications should be allowed on the amateur bands. Hmmm. . . do you think the two ideas could be somehow connected? Let's see. . . "take some of the frequencies away from land/mobile users to make room for commercial experimentation, and at the same time we can start suggesting that there is an abundance of 'unused Amateur Service frequencies'. . . and wouldn't it be grand if we could make those dumb hams think we were doing them a favor by allowing them to order pizza over an autopatch, while at the same time making it possible for other business communications to get a foothold on that frequency spectrum. Those idiot hams will be so busy stuffing their faces with autopatch-ordered pizza that they won't even notice that we're stealing amateur radio's birthright out from under their tomato-sauce-stained noses."

Mr. Haller, I have never met you but I am assured by those who have that you are a reasonable and concerned individual. I'd like you to remember that we amateurs are not stupid (at least not all of us, anyway). We can see through this silk purse for what it is—the ear of a swine. We do not buy for one minute that there are an excess of "unused Amateur Service frequencies." Your promise of "secondary use" is laughable. If you're getting letters from amateurs who want this kind of "regulatory relief," tell them to buy their way onto the land/mobile service or whatever service is appropriate to their intended use. If you feel that business interests need more frequencies, give 'em some of that 200 megahertz of excess U.S. Government allocation that isn't being used. If they feel like ordering a pizza, tell them to use the phone.

Why is it that every time the FCC runs up against a small group of boneheads in amateur radio—whether it's the BARF idiots, the illegal phone-patchers, or just a bunch of hams who have forgotten what amateur radio is supposed to be all about—why is it that the FCC always tries to wash their hands of the problem by giving away a piece of amateur radio's heritage, instead of what they should be doing with our tax dollars. . . stringently enforcing the rules?

I'm sick and tired of the FCC using the "no money" excuse for not doing their jobs. Money is tight everywhere, boys. It means you have to find ways to do your job better. It doesn't mean you can simply write off an entire area of responsibility by rewriting the rules to make a problem disappear. If I did that, I'd lose my job. When a U.S. Government employee or agency does it, it is nothing short of theft. You're stealing my tax money, and it really ticks me off! If you are unable to do the jobs the American people are paying you to do. . . quit! Get the hell out of the way and let someone who knows how to run a business in there. Just stop crying to us about how little money you have and how short-staffed you are.

To those of you who have requested this kind of a rule change, I ask that you sit down for 10 minutes and ask yourself. . . is ordering a pizza over your repeater worth the raping of amateur radio? If you still think this is a good idea, drop me a line and I'll send you your reward—30 pieces of silver.

ARRL Up To Their Old Tricks

When the FCC decided it couldn't deal with licensing the Amateur Radio Service anymore (once again, abdicating their responsibility with the feeble "no money" excuse), the ARRL saw its chance to grab some more power and coyly offered to handle the licensing for them. The FCC said sure, but you can't have a monopoly. The ARRL then said, "Forget it—if we ain't the only game in town, we don't want to play."

Well, we all know how things turned out. VECs popped up all over the country, and the ARRL had to swallow its oversized pride and enter the arena as one of many VECs.

A few years ago, it was suggested that special callsign requests could be handled in much the same way. A private organization could do all the work of passing out callsigns, and the FCC wouldn't have to bother their over-worked and under-funded heads about it. Again, the geriatric gulag at the ARRL saw the chance to grab a little power. "We'll do it! We'll provide this service for amateur radio. Aren't we just the most nicest, altruistic and caring organization ever? Oh, by the way, one small, insignificant point. We want the exclusive right to do this."

The FCC told the League to stick it. They suggested that if amateurs wanted special callsign allocation, a system similar to the VEC program could be set up, but the ARRL was not going to get the exclusive. You guessed it. The ARRL backed out, making it seem like the FCC was the bad guy for not letting the nice and only-thinking-of-us-hams ARRL give you a callsign with your initials in it.

Well folks, the Geritol set at the ARRL have done it again, only this time they were a lot sneakier about it. Incorporated into the wording of HR 1674, the "Federal Communications Commission Authorization Act of 1991," was the following:

The Commission for purposes of providing specialized, radio club, and military-recreation call signs, may utilize the voluntary and uncompensated services of an incorporated association of amateur radio operators with more than 100,000 dues paying members representing all States which has a tax-exempt status under Section 501(c)(3) of the Internal Revenue Code.

Gee, what organization does that sound like to you?

Luckily, Fred Maia W5YI got wind of this behind-the-scenes power grab and contacted the House Committee overseeing the legislation. The wording was changed to let *any* amateur radio organization authorized by the FCC act as a special callsign provider.

There are two issues at work here. The first is the sneaky way the ARRL got the original wording into the bill without the amateur community ever knowing. I thought the League was "of, by, and for the radio amateur."

Of course, the ARRL often forgets that they DO NOT represent the interests of the majority of hams in this country. The majority of licensed amateurs in this country are not members of the League. This is unfortunate, because amateur radio desperately needs a national lobbying organization. What the League leadership has become is an ineffective, self-perpetuating group of old men who lost their ideals years ago. The ARRL's sole reason for being has become of, by and for the ARRL. Is it any wonder that the majority of hams in this country have chosen not to join this joke of an organization?

The biggest crime is that there is no alternative organization, and neither should there be. The ARRL is, for better or worse, THE national amateur radio organization. This blatant power grab only goes to further prove how ineffective those old men are. I only hope that by the time all the self-serving and lifeless old farts who pull the strings at the League die off, there is an Amateur Radio Service still around to protect.

(Note to League officials who take offense at the above statements: Like my mother always said when she would yell at all four of her sons for something only one or two of us were responsible for, "If you didn't do anything wrong, then I'm not talking to you." Of course, the question always remains, if you didn't do anything wrong, why do you feel that I AM talking about you?)

(Note to readers who want to write me nasty letters and accuse me of "bashing" the League: This is America, and in America we are allowed to speak out when we feel something is wrong with our government. The ARRL is setting themselves up as the "government" of U.S. amateur radio. If you would like to debate the issues

involving ineptitude and lack of leadership at the ARRL, I would be glad to hear from you. If you are one of those people who thinks we should shut up and be grateful for the benevolent wisdom of those who are mismanaging our affairs, then please, keep your letters to yourself.)

The second issue that this whole affair brings up is . . . do we really want anyone other than the FCC handing out callsigns? I don't. If we want to change the current system and allow for the issuing of expired and special callsigns, the people who are being paid to do it are the FCC. Instead of writing a rule that gives the responsibility to someone else, why doesn't the FCC write a rule that allows them to charge a fee for the extra work involved in administrating such a program (though, why checking the database to see whether or not W1DC is currently assigned should cost anything is beyond me)? Most states offer custom license plates, and they charge a premium for the privilege. So why doesn't the FCC charge 50 bucks for licensing and renewing special callsigns? This would more than pay for the few seconds of effort involved in issuing the callsign, and the rest could be put into the FCC enforcement budget. Of course, then they wouldn't have any excuses for not doing *that* part of their job.

Broadcasting

Let's start this section with a few basic assumptions. Assumption number one is that the ARRL is a broadcaster, and they make these broadcasts with the express permission and blessing of the FCC. They can even pay someone to operate the station during broadcasts. This is all fine, and well, and perfectly legal.

Let us also assume that other people who broadcast on the amateur bands, such as K1MAN's endless propaganda, and the "Newsline" show I've heard a few times, and any other group out there who puts a ham radio news show on the amateur bands are operating under the same provision of the FCC rules, and as long as they operate within the regulations, everything is hunkey-dorey and nobody gets a "Notice of Forfeiture" from our pals at the FCC.

Let us also assume, because hams all over the country have adamantly voiced this opinion to me (though I certainly would never say such a thing), that Glenn Baxter K1MAN is one of the biggest horse's behinds in amateur radio. I hate to give little people like Baxter more publicity by noticing them, but this current crop of comedy from what locals have called "Maine's #1 embarrassment" is just too funny to let by without comment.

Baxter is currently fighting a $1500 fine. He was accused of starting one of his broadcasts on top of a QSO in progress, as well as some other stuff having to do with using the amateur bands to conduct business (gee, I wonder if he and Mr. Haller are buddies) and broadcasting to non-amateurs. Baxter's defense is that the ARRL does it, so it's OK for him to do it (Baxter goes on for page after page, but this is his premise in a nutshell). As long as he publishes his broadcast schedule and announces on the frequency that his broadcast is about to start, he thinks he's following FCC regulations to the letter.

Wrong! As my mother used to say (I hate to keep bringing my mother into this, but as often happens in life, when you're faced with a jackass, mom's brand of common sense is just the ticket), "Two wrongs don't make a right." Just because the League breaks the law by not checking to see if a frequency is in use, it doesn't mean that Glenn "all mike and no speaker" Baxter can do it, too. Glenn. . . rent a brain, buddy. You're wrong, and so is the League.

I have read and reread the FCC rule book, carefully going over the regulations that permit very specific types of broadcasting. Nowhere in those regulations does it give those who broadcast the right to break any other FCC regulations, including the rules regarding control operators, good amateur practice, and not causing willful interference. Those rules are still in effect, and the League, Baxter, and anyone else who wants to broadcast amateur bulletins should keep that in mind.

Baxter also claims that ARRL 5 wpm code practice is obviously aimed at non-amateurs, so it must be OK for him to direct broadcasts to SWLs and other non-amateurs. Well Glenn, that razor's-edge mind of yours has neglected one small paragraph in Part 97. Specifically, 97.111(b)(5) which states:

In addition to one-way transmissions specifically authorized elsewhere in this Part, an amateur station may transmit the following types of one-way communications: (5) Transmissions necessary to assisting persons learning, or improving proficiency in, the international Morse code.

Did you read that? It specifically says "learning." The ARRL is well within the law in broadcasting 5 wpm code practice, and I support the League 100% in this endeavor. It's one of the few programs that the League has enacted that is of a direct benefit to amateur radio. So, why is Baxter bashing the League? Do you think perhaps he had a slight problem with "Reading Comprehension 101" in school?

Glenn, pick up your ego and pay the damned fine. If you're not going to play by the rules, don't play at all. If you don't like the rules there are simple ways to suggest changes, but this ego-gratifying nonsense is getting you (and amateur radio in general) nowhere. It is only making us more enemies at the FCC.

The Baxter broadcasts that I have monitored have spent more time talking about Baxter himself than any other subject. Maybe I should heed the advice of those who tell me to just ignore this. . .er. . . guy. I've been told that his incessant babble only digs his own grave, because the more he talks, the bigger an idiot he appears to be (I don't waste my time listening to enough of his broadcasts to know, but this is what I've been told time and again from hams all across the country). The biggest favor Baxter could do amateur radio, and himself, is to shut up and go away. It appears that all he's doing is serving his own ends, not those of amateur radio, and judging from the hundreds of hams I've spoken with over the past few months, the vast majority of amateur radio operators are getting tired of listening to him.

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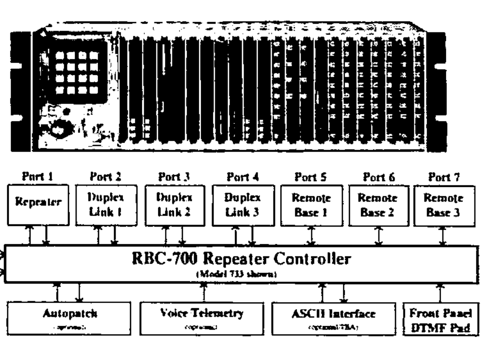

The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

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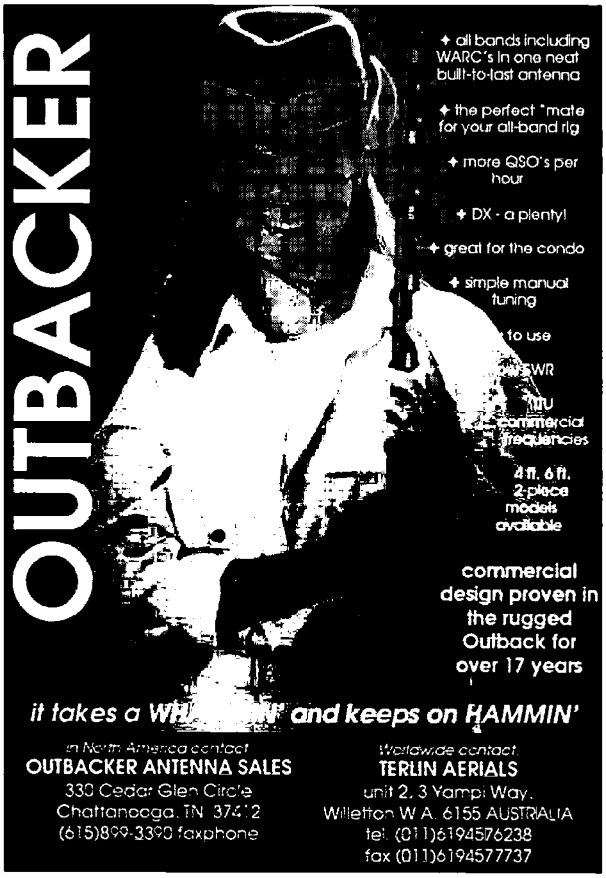

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PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
P.O. Box 1079
Payson AZ 85541

A Few Good to Fair Days

December is another of the "doldrum" months on the HF bands, but there are some real advantages as well: The bands are generally quiet, with atmospheric noise from thunderstorms at a minimum. This means that 160 and 80 meters, along with 40 and some higher bands, ought to be good for both local and DX work. The higher frequency bands from 20 through 10 meters will either close before dark, or not be open much during the day under the worst conditions.

December is the month halfway between the equinoxes, and like June, it doesn't offer much HF opportunity on the 10, 12, and 17 meter bands. However, there will be some good days during the month as well as poor ones.

Expect the poorest conditions around the first day or two of the month, and again during the week of the 11th through the 18th. The remaining days can be good to fair, as shown on the calendar and time-band-country chart. On VHF there may be some cold-front propagation along boundaries of air masses having different densities and temperatures. Sometimes a weather map can be helpful in deciding where to point the 2 meter beam. Don't expect any 6 meter openings this month.

As I write (in August), the solar flux is UP again (surprise, surprise) between 250 and 300, and the A and K indexes are low. Hey, Sol, this is supposed to be the DOWN side of your cycle! What gives? To paraphrase an old saying: "A flare every day keeps the hams away." It has been true all year. So, keep your ears open for WWV at 18 minutes past each hour for an update of conditions, and a forecast for the following 24 hours . . . plus a synopsis of the past 24 hours. Great service, that!

A partial eclipse of the moon will take place on December 21, and can be seen in Iceland and Greenland, the arctic regions, the N.W. of S. America, N. America, the Pacific Ocean, Australia except for the extreme west, Asia except for the S.W., and extreme northern Europe. 73

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20/40(1)	20	—	—	—	—
CANAL ZONE	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
ENGLAND	20	20	20/40	—	—	—	—	15/17	15/17	—	15/17	20
HAWAII	15/17	15/17	20	20	20	20	20	—	—	—	—	15/17
INDIA	20(1)	20(1)	—	20(1)	20(1)	—	—	—	—	—	—	15/17(1)
JAPAN	—	—	—	—	—	20	20	—	—	—	—	15/17(1)
MEXICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
PHILIPPINES	—	—	20	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—	—
PUERTO RICO	20	20	20	20	20	20	20	15/17	15/17	15/17	10/12	15/17
SOUTH AFRICA	—	40(1)	20	20	20	—	—	15/17	10/12	20	—	—
U.S.S.R.	20	20/40	20/40	—	—	—	—	—	—	15/17	15/17	20
WEST COAST	15/17	15/17	40/80	40/80	40	40	40	—	20	15/17	15/17	15/17

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
ARGENTINA	15/17	15/17	20	—	—	20(1)	—	—	—	—	10/12	10/12
AUSTRALIA	15/17	15/17	—	20	20	—	20	—	—	—	15/17(1)	15/17(1)
CANAL ZONE	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
ENGLAND	20	20	—	—	—	20(1)	—	—	—	—	15/17(1)	15/17(1)
HAWAII	—	—	20	20	20/40	—	20	—	15/17	15/17	15/17	10/12(1)
INDIA	15/17(1)	20(1)	—	—	—	20(1)	20(1)	—	—	—	—	15/17(1)
JAPAN	15/17(1)	—	—	—	—	20	20	20	—	—	—	15/17(1)
MEXICO	15/17	20	20	20	—	20	20	15/17	15/17	10/12(1)	10/12	10/12
PHILIPPINES	15/17(1)	—	20(1)	—	—	—	20(1)	20(1)	—	—	—	—
PUERTO RICO	15/17	20	20	20	—	20	20	20	15/17	10/12(1)	10/12	10/12
SOUTH AFRICA	—	—	20/40(1)	20(1)	—	—	—	15/17(1)	15/17(1)	20(1)	—	—
U.S.S.R.	20	20	20	20	—	20(1)	—	—	15/17(1)	15/17(1)	15/17(1)	20

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
ARGENTINA	10/12	15/17	15/17	20	20	—	—	—	—	—	10/12	10/12
AUSTRALIA	10/12(1)	15/17	15/17	20	20	20/40	20/40	20	—	—	—	10/12(1)
CANAL ZONE	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
ENGLAND	20	20	20	20	—	20(1)	—	15/17(1)	15/17(1)	—	—	20
HAWAII	10/12(1)	15/17	20	20	40	40	20	20	—	15/17	10/12(1)	10/12(1)
INDIA	—	15/17(1)	15/17(1)	—	—	—	20(1)	20(1)	15/17(1)	15/17(1)	—	—
JAPAN	15/17	20	20	20	20	20	—	20	15/17(1)	15/17(1)	15/17(1)	15/17
MEXICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
PHILIPPINES	—	15/17(1)	15/17(1)	—	—	20	20	20	15/17(1)	—	—	—
PUERTO RICO	15/17	15/17	20	20	20	—	—	—	—	10/12(1)	15/17	15/17
SOUTH AFRICA	—	—	—	20(1)	—	—	—	20(1)	15/17(1)	15/17(1)	—	—
U.S.S.R.	20	20(1)	20(1)	20(1)	—	—	—	—	—	—	—	20
EAST COAST	15/17	15/17	40/80	40/80	40	40	40	—	20	15/17	15/17	15/17

Notes (1) Possible but rare dual bands (10 or 12, 15 or 17, 20 or 40). Try where shown. The highest possible bands shown. Also try next lower band at times shown.

DECEMBER 1991

SUN	MON	TUE	WED	THU	FRI	SAT
1 P–F	2 F	3 F	4 F	5 F	6 F	7 F–G
8 G	9 G	10 G–F	11 F–P	12 P	13 P	14 P
15 P	16 P	17 P	18 P	19 P–F	20 F	21 F–G
22 G	23 G–F	24 G–F	25 F	26 F	27 F–G	28 G
29 G	30 G	31 G				

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The solution to most interference, intermod, and desense problems in repeater systems.

- 40 to 1000 Mhz tuned to your frequency
- 5 large helical resonators
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- Low noise—high overload resistance
- 8 db gain—ultimate rejection >80 db
- GaAs fet option (above 200 Mhz)
- Cast aluminum enclosure
- N, BNC, and SO239 connector options

Typical rejection:
±600Khz @ 145 Mhz: 28db
±1.6 Mhz @ 220 Mhz: 40db (44db GaAs)   ±20 Mhz @ 800 Mhz: 65db
± 5 Mhz @ 450 Mhz: 50db (60db GaAs)   ±20 Mhz @ 950 Mhz: 70db

AUTOMATIC IDENTIFIERS

- Up to 8 EPROM programmed messages
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- Low power option
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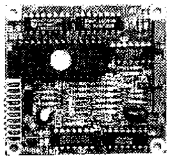

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Model
ID-2B

The ID-2B provides required station identification without troublesome diode programming. The "ID over voice inhibit" circuitry allows for courteous operation by not allowing an ID until the next squelch closing.

ID-2B Wired/Tested $99.95   **ID-2B-LP Low Power $109.95**

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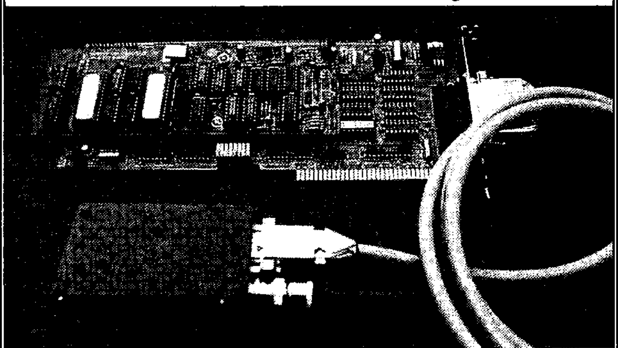
CIRCLE 17 ON READER SERVICE CARD

the PackeTwin™ System



The PackeTwin data radio system, with integrated 9600 bps radio modem (G3RUH/K9NG compatible) and a 440 Mhz radio (*antenna* not included).

The PackeTwin is a high performance, dual-channel, sync/async PC interface card for data radio systems, with TCP/IP and AX.25 software (executable and driver sources provided.) Speeds of 1200 to 1 Mb/sec operation utilizing full duplex DMA. RS-422, RS-232, and TTL. The PackeTwin data radio is a single channel, half-duplex, crystal controlled unit delivering 2 watts output available in the 430-450 Mhz and 450-470 Mhz frequency ranges.

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